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PRESIDENTIAL ADDRESS

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YESTERDAY, TODAY, AND, TOMORROW

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If we were able to look back in time with the ease with which the comic strip artists try to do, we could watch the flow of life as it preceded us. We could see the coming and going of all the fascinating forms which the geologist, the paleontologist, and the paleobotanist have read from the record of the past. We could determine the ancestors of the algae which left their evidence upon the earth as early as perhaps a billion years ago. We could answer the question as to how these plants and primitive animals could have given rise to such an impressive flora and fauna as extend from Cambrian times until the present.

There were the trilobites and ammonites skyrocketing in numbers to pass on, leaving only their fossil evidences behind them, and yielding their place to the up-and-coming vertebrates of a later day. The great forest of giant equisetums and lycopods covered the warm swamps and deposited their dead bodies to give the "coal measures" for warmth and energy in our time. Now only small living reminders of the past glory of these forms are left. Later came the Age of Reptiles, the time of the giant dinosaurs who moved on their sluggish way through the swamps of the period. These giant reptiles passed from the earth, leaving behind remnants—some of which developed into the snakes and lizards of the present day, and others became the ancestors of modern animals of other kinds.

Then, gradually in subsequent ages the influence of mammals extended on the land, in the air and under the water, until the forms of life which we see today came into being.

This was not an idyllic world. By our standards, it was a hard, even brutal, life in which all forms competed in the struggle to survive. Tyrannosaurus rex, a powerful and vicious killer, satisfied his need for food upon the flesh of the docile Brontosaurus or other of his relatives. The saber-toothed cat pierced the skin of his victims in order to suck their blood. It was, as my grandfather used to say, "a dog eat dog world and the devil take the hindmost."

But it was a natural world in which the natural process of things was carried out.

In this process there have been certain continuing themes. The most important of these is the constant necessity for energy and the ever-active struggle to obtain food to supply it. Because green photosynthetic plants have the ability of storing sunlight in simple food, these plants have always been the middlemen between solar energy and that available for other forms of life. Animals are dependent upon such plants for their source of energy. The ecologist recognizes this interrelationship as the food chain. In such a chain, the photosynthetic plants are the producer organisms. Herbivores obtain their energy from the plants and in turn pass it along to the flesh-eating carnivores who must obtain their energy second hand, as it were. Throughout all of these transfers the Second Law of Thermodynamics applies, and the amount of available energy decreases with each transfer. This means that in any such food chain the number of individuals that can be sustained in each level (that is, producer, herbivore, or carnivore) decreases the more remote it is from the ultimate energy source of the sun.

In a given community, when the plants decreased in numbers the animals which fed upon them decreased also. When predators became too common they killed off excessive numbers of their prey. This in turn led to the decrease in the number of the predators themselves. This was not an easy world—but it was a world in balance. As we look back in time, we see that this check and counter check is a characteristic of the natural condition. All of this simply demonstrates that there is a definite relationship, a balance in nature, which exists today and which has existed through all the time past. Such a balance is centered around the constant struggle to obtain energy and the associated materials necessary for the continuance of the life of each individual.

Into such a balanced enviroment, perhaps as much as a million years ago, came a unique animal, a relatively insignificant fellow as compared with some of the other forms which lived at the same time and under the same conditions. This was man. At first he was little better than the other animals. He found shelter where he could. He found his food where it was, following it as it ripened or as it migrated with the seasons. He depended upon the same abilities as other predators for his means of obtaining meat. Finally his greater intellectual potential began to show itself. He found that stones were better than fists to strike his prey, and that shaped

stones were better than shapeless ones for the same purpose. He found that fire could be his friend as well as his foe.

As he struggled to exist, man began to demonstrate a great difference between his kind and other animals. This was man's ability to shape his enviroment to his own needs. Slowly at first, but with ever increasing speed, man found that he could adjust the world about him in an effort to make it a better place for him to live.

Somewhere along the way in his cultural development man made one of the greatest single advancements that he has ever made. This was the discovery of agriculture and with it the domestication of animals. We do not know exactly how nor when this great achievement came about, but without its discovery the advancement of civilization could not have occurred. Once it was possible to localize the food source, communities came into existence, and the trend toward urbanization was on its way. Also the convenience of primitive farming led to an increased population. This in turn, led to overcrowding and, consequently, to migrations.

At first man's effect upon his environment was little different from that of the other animals. He fitted into the balance of nature. This balance began to be upset, however, by one major factor. This factor has been man's propensity constantly to increase in numbers. At first, even with the practice of agriculture, the effect of a few hundred thousand human individuals upon the earth was little different from that of the animals. But the few hundred thousand became millions, and the millions became billions, and this increase has provided a matter of serious concern to all mankind.

The population of the earth at the beginning of the Christian era has been estimated at between 210,000,000 and 250,000,000 of people. Little information is available upon which to base estimations from that time until about 1650 when the population is considered to have been 545,000,000. From 1650 until the present there has been a steady and rapid increase. During the past century the population has more than doubled, for in 1850 there were 1,171,000,000 people while in 1950 there were 2,500,000,000.[1]

The effect of mankind upon his environment has been a total effect upon both the physical and biological aspects. We could point out how man has speeded up the normal process of erosion until it has become a serious problem for him. We could discuss his efforts to control the weather. However, the basic problems of man's effect upon the balance of nature, and the conclusions which can

be drawn from a study of these problems are similar no matter what aspect of the environment is considered. Recognizing this fact, let us observe the effects of man upon the world of living things for the purpose of demonstrating some of these problems. Also, since we are most interested in our own country let us limit our considerations primarily to the United States.

Man's primary effect upon his biotic environment has been a three-fold one: 1) he has depleted or exterminated many different kinds of plants and animals, 2) he has increased the abundance of other forms, 3) he has moved organisms around from place to place, introducing them into environments where they were not originally found.

These three effects are not easily separated in nature. They interact in various ways. This fact is well illustrated in an item which appeared in Bennett Cerf's column in This Week magazine of October 30, 1954.

> Not long ago, the editors of the "Farmer-Stockman" printed a picture of a deserted farmhouse in a desolate, sandswept field, then offered a prize for the best 100-word essay on the disastrous effect of land erosion. A bright Indian lad from Oklahoma bagged the trophy with this graphic contribution:
>
> "Picture show why white man crazy. Cut down trees. Make too big tepee. Plow hill, water wash. Wind blow soil. Grass gone. Door gone. Window gone. Squaw gone. Whole place gone to hell. No pig. No corn. No pony.
>
> "Indian no plow land. Keep grass. Buffalo eat grass. Indian eat buffalo. Hide make plenty big tepee. Make moccasin. All time eat. Indian no hunt job. No work. No hitchhike. No ask relief. No build dam. No give dam.
>
> "White man heap crazy."

Originally there was a definite balance between the buffalo and the grassland. The presence of the Indian did not disturb this balance greatly and as a matter of fact the Indian became a part of the very simple food chain. The Indian took only what he needed and made use of every part of the animal. He even used the tip of the tail for a fly swatter. But in the 1870 and 1880's the white man came and slaughtered millions of buffalo for food, for hides and to make room for cattle grazing. According to reports 50,000 buffalo were killed for their tongues alone, the carcasses being left to rot.[2] This slaughter had a pronounced effect upon those Indians who were dependent upon the buffalo for their existence, as the result the number of both decreased rapidly. Following the removal of the buffalo came cattle and overgrazing. This led to the replace-

ment of the blue stem grasses and other good range species by poorer quality plants such as sagebrush and tumbleweed. In some areas the "dirt farmer" pushed in, and the land was "turned wrong side up" as one Indian put it. The result of the poor farming techniques was a lowering of the water table and the appearance of dust storms.

Here we see all three of the effects of man upon the biotic balance: the depletion of buffalo and the native grasses; the introduction of the exotic forms, such as the tumbleweed and cattle; and the increase in abundance of both native forms (sage-brush) and of introduced forms (cattle and tumbleweed). Note also that "civilized" man's effect on his environment led to depletion of his own kind in the decrease of the Plains Indians.

While of course, we recognize that these effects of man are not readily separated in nature, it is necessary to isolate them for purposes of discussion. When we do, we find in each type that man's activities have either been direct or purposeful, or they have been indirect or accidental. Let us consider first man's purposeful depleting or exterminating effect.

In the settlement of the country, man actively destroyed many plants and animals. Forests originally covered almost one-half of the entire United States. But, the 822,000,000 acres of the forest at the time of Columbus have now dwindled to less than 150,000,000 acres as a result of the clearing and burning of the timber to make way for fields and homesites for the increasing and spreading population.[3] The cultivation of the land has played a great part in the settlement of the country. The total effect of cultivation has been summarized by Dansereau, who states that man:

1. Lays the site bare where it would be covered with life, which lowers the producing potential and frequently results in loss by wind and water erosion.
2. Disturbs the structure of both soil and natural vegetation.
3. Sets up brand-new equilibria that could not possible originate without him and which usually cannot perpetuate themselves without his continued interference.
4. Introduces new species much better equipped than the natives (as a rule) to take advantage of disturbed conditions, as well as a number of pests often disastrous to the native biota either as parasites or through competition.[4]

Following the clearing of the land and its cultivation has always come urbanization with the grass and soil of the woodland and plain being replaced by paths of concrete among a forest of stone.

Likewise man's purposeful activities in response to economic pressures have produced a destructive effect upon the environmental balance. Excessive trapping for the fur pelt is one example. Another is that of hunting, particularly market hunting. At one time it was possible to buy wild turkey for 25 cents a piece. And, of course, almost everyone has heard of the story of the extinction of the passenger pigeon. Such illustrations do not condemn true sportsmen; however, in this category should not be included the hunter who shoots at anything that moves just for the fun of killing, or the fellow who has described his hobby to one of our staff members as shooting off the heads of birds just to show his marksmanship.

Moreover, the eradication by man of predators, such as hawks, owls, crows, foxes, and coyotes, has destroyed many animals in an effort to regulate their numbers. In much the same way, man has exterminated many organisms in an effort to control vermin. In analyzing the effectiveness of these activities, we need to consider the actual amount of damage done by the predator or the vermin. In some cases, also, the question has been raised as whether the control measures really are worth some of the problems which may result from them. The spreading of toxic materials to control the fire ant in the Southeast is a good example of such a situation.

These direct actions represent only one aspect of man's depletion of other animals and plants. Equally important are certain activities of man which frequently produce indirect destructions of existing forms. For example, at the beginning of this century Lower Klamath Lake between Oregon and California was a breeding grounds for many wildfowl. The lake was partially drained to permit homesteading on the reclaimed area. Instead of providing desirable and productive land for the homesteaders, however, the region became a desert waste of peat and alkali which caused duck sickness that destroyed thousands of wildfowl.[5]

Flooding by raising lake levels or damning streams can be just as destructive as draining. The Upper Peribonka Dam in Quebec flooded 200 square miles, drowning many spruce and pine trees. These decomposed and created a serious pollution problem in the stream below the dam. The accumulation of the water behind the dam in the spring lowered the level of the river below and destroyed the mollusks which were the principal food of the economically important muskrats of the area. The aquatic flora above the dam was exposed to air in December and is in too deep water in August.

This destroyed the yellow water lilies and decreased the number of moose which used them as an important food source.[6]

Pollution, likewise, is an important indirect method of the destruction of organisms. This problem is under serious consideration by government agencies and citizens groups. Because various familiar aspects of pollution are before us in the newspapers, perhaps one less obvious type of example may be mentioned. Fuel oil released from the disaster of the S. S. Robert E. Lee near Plymouth, Massachusetts, in 1928 saturated the feathers of wildfowl that landed in the area during fall migration. Observers reported that much of the entire north side of Cape Cod was covered with dead ducks which had been killed because they could not fly because of the oil in their feathers.[7] Of course, the destruction of the vegetation in the Copperhill area on the border between Tennessee and Georgia, and the death toll in Donora, Pennsylvania, a few years ago illustrate what can happen as a result of air pollution.

Timber cutting and land clearing have been mentioned as direct aspects of man's destructive influence. They have an equally important indirect effect as well. Land clearing damages the entire natural community, destroying the habitat for much of the native wildlife.

Another of man's activities which has both a direct and an indirect effect upon the balance of nature is the use of fire. Each year the newspapers carry numerous reports of disastrous forest and brush fires. In 1957, 83,392 forest fires burned 3,409,038 acres in the United States. In the South alone 44,112 fires destroyed 2,218,371 acres.[8] The effects of fire, both direct and indirect, are well known but thinking people frequently do not give them the serious consideration they deserve.

Destruction and depletion may be a two-edged sword when the balance of nature is upset. A group of western sheep owners were having trouble with coyotes killing some of their stock. They banded together and destroyed all of the coyotes in the region. The result was a temporary respite from the destruction of the sheep but an increase in the rabbit population. Before long, the rabbits and other natural prey of the coyotes became so prevalent that they began depriving the sheep of their range. Recognizing the error of their ways, the ranchers reintroduced and encouraged the presence of coyotes in an effort to return to the proper balance of nature. Unfortunately for the ranchers, now there were not

enough rabits to feed the increased number of coyotes, so the coyotes destroyed the sheep in far greater quantities than before the control efforts were undertaken.[9]

Not only do man's destructive activities decrease the number of organisms but frequently, these same activities provide for an increase in the number of other forms. Man's influence in increasing the abundance of species is his second major effect upon his biotic enviroment and the natural balance. Cultivation has produced increases in various ways such as in the number of individuals of the planted crops. Reforestation and tree farming are both methods of cultivation which tend to increase the numbers of certain species. Irrigation, another tool of agriculture, has turned deserts into productive areas and increased the wildlife and non-cultivated plants in the region as well. With the development of grain crops have come increases in the grain-eating birds and the predators which prey upon them. The raising of domesticated animals and the activities of wildlife management both have brought about increases in the animal populations.

Urbanization has completely replaced natural conditions by man-made ones. While this has resulted directly in the depletions of some forms certain species have joined man in his city life in an indirect way. Increased numbers of such friends as the silverfish, the cockroach, the bedbug, the housefly, and the house mouse and rat have come to occupy man's homes and buildings.

Some forms which have increased in numbers have done so because they were introduced into a new area where they were able to thrive. Organisms have been found where they were because they have been relatively well adapted to live there or because they have been prevented from moving to a more favorable location. The number of organisms in a given habitat always has depended upon what the ecologists call the biotic potential, which is the maximum possible rate of population increase, and the enironmental resistance, which is the tendency of the environment to prevent or hold in check any increase. As a species has moved from a habitat where the environmental resistance was high to a place where the environmental resistance was low, the population has increased rapidly.

The purposeful introduction by man of new forms into areas where they have not existed is another major effect of man upon the balance of nature. Sometimes this has been done in an attempt to find new organisms to enrich the present flora and fauna, for the

purpose of increasing the food supply, for ornamentation or for use as new game animals. The water hyacinth, introduced as an ornamental plant into the United States from South America, has subsequently become a serious problem by blocking channels and streams in the South. Efforts at biological control of pests have caused the introduction of new forms, for example, the importation of a chysomelid beetle, *Chrysolina gemellata,* to control the Klamath weed, a pest of western rangelands.

Still other introductions have come as a result of accidents. The Russian thistle is an outstanding example of one such plant. Introduced in contaminated flax seed from Russia in 1886, nine years later it had spread through sixteen states and thirteen Canadian providences.

For the most part, the introduction of exotics failed and the ecological balance was only briefly disrupted. However in some cases the imported forms have found the environmental resistance of the new area much than less in the original habitat and their numbers skyrocket. The rabbits of Australia, the starling and English sparrow of America are all examples of successful importations. Man has now begun to realize that introduction of exotics should be attempted only by competent authorities after very serious study of the ecological factors involved.

From a consideration of man's depletion of some kinds of organisms, his increase in the number of others, and his introduction of still others we see that man has had a pronounced effect upon his environment, an effect that frequently has disrupted the natural balance of things. Certainly we must admit that man's influence has been a harmful one from the point of view of nature, but the sad thing about it is that man's effect often has been detrimental to himself as well. As we stand today and look backward, what justification can we find for this disruption of nature's balance?

Shall we, then, condemn our ancestors for cutting down trees that we would like to have today or for other acts which brought about the destruction of various forms of life. No! They were sincere in believing that there was more than enough of everything for everybody. They did not realize the possibility of a tremendously increased population and the pressures upon the land created thereby. Their ignorance and shortsightedness are understandable when viewed in the light of what they believed.

Before the establishment of well developed agriculture and of large herds of cattle along with proper means of transporting pro-

cessed food to the point where it was needed, man had to expand his biotic environment for food. This was a matter of necessity, the old "him or me" attitude, and man had the ability to win out at the risk of exterminating the food supply.

However, the time when ignorance and necessity could apply has long since past. We must look for other explanations and the ones we find are not very satisfactory. For one thing, many people show a lack of willingness to change from detrimental practices even when shown they are wrong. A county agent in another state once told of this attitude which he had to combat. After a farmer had been shown how he could improve his land by following proper soil conservation practices and be paid a tidy sum by the government for doing so, the farmer replied, "Well, I can see it's a fine thing. But, this is the way my pappy did it and if it was good enough for him it's good enough for me."

Although this fellow's reasoning may be explained in part by ignorance, much of the past destruction and damage to the environment is the result of abusive action by man either purposefully or not. When I was a child I made several pleasant visits to Heart's Content, a beautiful tract of virgin hemlock near my home in northwestern Pennsylvania. This area was visited again on a field trip taken when I was an undergraduate at college. The walk through the virgin land was just as stately and beautiful as ever, but suddenly the trail ended in a fence, and beyond the fence was complete barrenness. Not a tree or shrub was standing, and the topsoil was completely gone. The stark contrast on the two sides of the fence brought into sharp focus an attitude which explains many of our acts of depredation today.

The fly-by-night lumber mill operator, who stripped an area naked for a quick and easy profit and then moved on, is only one example of man's abusive actions. There was the market hunter, so interested in personal gain that he would kill the last animal to make his profit. If we stop and think for a moment, we will realize that these same malicious and malignant actions and attitudes exist today. Even in our own state, within the past few years, we have seen efforts to make a "killing" at the expense of land that belongs to the taxpayer, efforts which were successful in many cases.

We are no longer looking at the past but at the present as well. Nor are we concerned only with our natural resources. We are considering, as well, problems of our human resources which each of us meets in the routine activities of every day.

The teacher is blind if he is not aware of the attitude of far too many students—dare I say the majority—who believe that they should get the grade with a minimum of effort and learning. So, they boot-lick and cheat and even bribe. In schools with a highly developed honor system there are cases of dishonor.

The business man is aware of this in the attitude of the employees who apply every pressure possible to get the highest salary and yet in return try to get by with the poorest quality of work. As one employer put it, there is a need for an honest work break between the coffee breaks. The bludgeoning of management by labor and of labor by management exhibits this attitude well. We can admire those little known but successful businesses where labor-management relations are based upon an interest by both parties in the problems of the other rather than the power politics of those industries whose unpleasant labor-management relations appear regularly in the newspapers.

Evidences of the problem are all around us. There is the increased litterbug activity which has turned our roadsides into garbage dumps, the increase of juvenile delinquency—or is it parental delinquency?—the increased vandalism, the lack of common courtesy in dealing with other people, the necessity of paying a tip for service, the manner of many people when they get behind the wheel of a car, the teaching professor who is always late for class so that he can spend more time on his personal research, the corruption of government at all levels, the writing of students on the walls of a new classroom, or the scribbling of the executive on a clean linen tablecloth as he discusses some aspect of his business with an associate over dinner. There has developed a lack of respect for anything and anybody—except for oneself, a lack of sense of responsibility.

Brown, Monnett and Stovall, in *Introduction to Geology,* have summarized man's place and potential today. "Here, then, stands man, at a season of geologic springtime, a long story behind him, an uncertain future ahead . . . He stands at the youth of his race, with the all-powerful atom in his hand. He is ably equipped to claim the legacy for which the ages have toiled."[10]

What can be predicted for the future? We have seen that much of the problem of man's effect upon his environment has been the result of an increasing population and of social attitudes devolping within the increased population. How long the population will continue to increase and how great the number of individuals on the

face of the earth utimately will be is difficult to prophesy. Many workers have made such predictions, but those of Raymond Pearl has proven most interesting. If Pearl's ideas are correct, there will be a slowing down and leveling off of the growth of the world population. When and at what level this will occur cannot be known. Calculations by Woytinsky and Woytinsky indicate that stability of the population may not be reached in the twenty-first century. They estimate on the basis of existing data that the world population may be stabilized at a level of four billion persons.[11]

Four billion persons represent a tremendous number of individuals to feed. Almost double the present population. Experts differ as to the ultimate ability of the earth to maintain this number. Agricultural experts are more confident than are students of population. Studies reported by population experts indicate that only seven per cent of the total land area, or two per cent of the total surface of the earth, is fully suited to agricultural production.[12]

The productivity of any land depends not only on the soil fertility and climate but also to a great extent on the agricultural skill of the population and the willingness to achieve. Woytinsky and Woytinsky state, "The core of the problem of the carrying capacity of the earth is not the scarcity of fertile land in comparison with the number of mouths that must be fed, but the insufficient ability of men to make full use of their available resources."[13]

In order to increase the productive capacity of the world, it will be necessary to do a great many things. Additional acreage under cultivation will be required. Estimates indicate that close to one and one-half billion acres of land can be brought into production, not readily, but if necessary.[14] A more intensive and efficient use of land already in cultivation will be required. Better control of insect and weed pests and other destructive agents by competent scientists must occur. The loss by spoilage and deterioration between the harvesting of the food and its ultimate consumption can be lowered. Whatever may be done, the increase of food production will be hard and slow and involve considerable technical advancement.

One of the great difficulties in feeding the additional numbers of people will be in providing for a more even distribution of food over the globe. Even today people are starving, yet there is more than enough food in the world. Once more we turn to the words of Woytinsky and Woytinsky. "The modernization of agriculture

and the industrialization of underdeveloped countries can be achieved only if the advanced countries help them to obtain higher economic standards through full utilization of their resources by means of modern techniques. Here, economic problems merge with political considerations."[15] Again we come face to face with the problem of the interest of self above the welfare of our fellow man whether on an individual or a national basis.

If man's increased population continues to disrupt the balance of nature by wasting the forest resources, permitting the destruction of the land, being satisfied with inadequacy, that is, if we continue in the way we have been going, there can be nothing but decadence, decay and disintegration ahead. Then we are truly on the downward grade. Dr. Albert Schweitzer has painted the picture well in his letter to a French bee keeper whose bees were the victims of an unfortunate dose of insecticides. "I am aware of the tragic repercussions of the chemical fight against insects taking place in France and elsewhere, and I deplore them. Modern man no longer knows how to foresee or to forestall. He will end by destroying the earth from which he and other living creatures draw their food. Poor bees, poor birds, poor man . . ."[16]

But it need not be so. Let man see himself in his proper place. Let him realize that while he has achieved partial mastery over his environment, he has a responsibility to his own kind, now and in subsequent generations, and to the environment of which he is a part, to fit his activities into the balance of nature. He can master his environment only by living with it and in it and for it, by realizing that he has a moral obligation to those who are to come and to nature itself to so use the world about him that his activities will fall into the great plan of things.

Let man see that there is more to life than simple materialism. Let him study his environment to learn more about the energy of the sun, the vibrations of sound waves or all of the other areas of research. But let man also be able to enjoy the beauty of a sunset, the call of a night bird or the harmony of a symphony. Perhaps you remember the words of Charles Darwin which are being quoted increasingly today. "If I had my life to live over again I would have made it a rule to read some poetry and listen to some music at least every week . . . the loss of these tastes is a loss of happiness, and may possibly be injurious to the intellect, and more probably to the moral character, by enfeebling the emotional part of our nature."[17]

If man loses his sense of beauty or of morality, or if he has lost these qualities and cannot regain them, then man's future is dark.

"Now we are at a crossroads. At this moment in history, when our population is growing, the demand for many products of fields and forest mounts, and the face of the land is changing, we can choose, perhaps for the last time, what we are to do with our land and our country."[18]

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A PANEL DISCUSSION

Thirty-Five Years of the Alabama Academy of Science: Where Have We Been and Where Are We Going?

Report of the Long-Range Planning Committee

Historical background. The earliest known formal scientific groups in America were organized by Benjamin Franklin, the first a Junto started in 1727, and then the Philosophical Society in 1743. In 1769, the latter became the American Philosophical Society held at Philadelphia for Promoting Useful Knowledge, and is still active. The American Academy of Arts and Sciences, also still functioning, was founded in 1780 at Boston. The first State Academy of Science was brought together in 1797 at Baltimore, Maryland. By 1848 when the American Association for the Advancement of Science was established, 461 qualified persons could be assembled as charter members. This Association is now recognized as the parent organization for 45 State Academies of Science, as well as for some 240 other affiliated organizations.

Although Alabama was admitted to the Union in 1819, its earliest scientific association, the Alabama Industrial and Scientific Society, was not set up until 1891. It was active for only nine years. In 1923, Wright A. Gardner, Professor of Botany and Plant Pathology at Auburn Polytechnic Institute persuaded the Alabama Education Association to sponsor a science division, which started with a single paper that year and increased to 16 papers at the April 1924 meeting. Formal chartering of the Alabama Academy of Science with 45 members was achieved during the latter year. Affiliation with the A.A.A.S. also occurred in 1924. Thus, 1959 is our 35th year of existence and the present meeting our 36th.

It is instructive to consider briefly some of the stated objectives of various State Academies, especially to see how well we are meeting these challenges:

Stimulation of research in science.
Diffusion of scientific knowledge.
Unification of science interests in the state.
Encouragement of publication.
Promotion of scientific interchange and acquaintanceship among scientists.
Stimulation of interest in science.
Interpretation of science to the public.

Promotion of formal education in science.
Cooperation of science and industry.
Assistance to state government.

It is usual procedure for the Long-Range Planning Committee to make its recommendations to the Academy's Executive Committee which can then act or present proposals to the entire Academy. This year there seemed to be a culmination of practical considerations over the course of some time in the past plus a general feeling on the part of many that the status of science in Alabama is not sound and that the Alabama Academy has not been exerting the influence which it should. Last summer, the chairman of this Long-Range Planning Committee was presented with an excellent group of workers (and thinkers) by President McCullough charged with making a critical but realistic evaluation of the Academy's present status.

The present committee met as a group after the Executive Committee meeting in November, 1958, and for some two and one-half hours discussed various items which had previously been presented by correspondence. At that time, there was general agreement that interest in these problems warranted presentation before the entire Academy, hence the present panel type of report. Several sub-committees set up at the time of the fall meeting have since pursued their enquiries with varying degrees of success, as will be apparent from the following presentation. To all those who have contributed time, thought and endeavor go our thanks for proposing improvements in Academy activities.

The dual nature of the problem. Whenever an organization such as ours begins to doubt its effectiveness and sees changes which it should be able to bring about, it is well for some of its influential members to look inwardly as well as outwardly for areas of improvement.

Internal affairs of the Alabama Academy. The first aspect, self-criticism, is good for the soul, even of an Academy of Science, but making this a constructive move is not always easy. A strong membership is necessary for a strong Academy and our membership committee, traditionally made up of the section chairmen (who are also Vice-Presidents) under the guidance of the President-Elect of the Academy, needs to exert itself more. Even more, each member should undertake his own recruitment whenever he meets anyone eligible for membership who is interested in science. Although our

principal public activity is at the time of our annual meeting, we can accomplish many things through less dramatic contacts of our members.

Many discussions were held considering ways of making Academy meetings more attractive as well as informative and challenging. Two features of the present 1959 sessions are the guest speaker Saturday morning before the joint Senior and Junior Academies and the Astronautics Symposium for both academies to be held this afternoon by Sections I and IX jointly. Many suggestions have been made to the committee concerning other, smaller meetings during the year, such as field trips, excursions to notable areas of the State, special symposia, and the like. A recurring idea is to extend the meetings to two full days; this would present the advantage of eliminating much of the rush now necessitated by one day and a half, but there is already a tendency for our members to attend only the Friday sessions. It would hardly be a step forward to schedule a Saturday afternoon program attended only by those presenting formal papers.

In order to tie the Junior and Senior Academies closer together, the executive committee of the latter voted last fall to extend honorary membership in the Academy to all sponsors of Junior Academy chapters. This action, making the Journal more widely available in the high schools, has been widely appreciated by the teachers. An even more important area, that of consolidation of Junior Academy activities with the Regional Science Fairs has received the special attention of our new Coordinator of Science Fairs, Father Twellmeyer, and the Counselors to the Junior Academy, Messrs. Reuben Boozer, James C. Wilkes, Jr., and Gibbes Patton. Together with Dr. McCullough, these four have labored to draw up concrete proposals for setting up regional Junior Academies. These were circulated to all Junior Academy chapter sponsors, eliciting a highly favorable response. A few objections were raised, but these proved to be due primarily to misunderstandings with some concern about a mandatory increase in amount of sponsors' work countered by fear of some that they would be surrendering activities to the Science Fairs.

The Long-Range Planning Committee recommended formal establishment of the Regional Junior Academy activities and approval was voted unanimously at last night's Executive Committee meeting. The provisions will be summarized by Dr. J. C. Wilkes.

SUGGESTED CHANGES IN THE PROGRAM OF THE ALABAMA JUNIOR ACADEMY OF SCIENCE AND THE REGIONAL SCIENCE FAIR ACTIVITIES OF THE ALABAMA ACADEMY OF SCIENCE.

The following points summarize the recommendations prepared by the Sub-Committee of the Long-Range Planning Committee of the AAS:

1. The State of Alabama should be divided into regions which will be at once the regions of the Regional Science Fairs and the regions of the AJAS, these regions to correspond to those in existence for the Regional Science Fairs.

2. Regional meetings of the several regions of the AJAS to be held simultaneously with the Regional Science Fair of that region and at the same location.
   a. The Regional Science Fairs will continue under the present plan of supervision laid down by the Alabama Academy of Science.
   b. The administration of the Regional Junior Academy of Science activities will be under the supervision of the Regional Counsellor of the AJAS, appointed by the Permanent Counsellor of the AJAS.
   c. In making the appointments of both the Regional Counsellor and the Regional Coordinator of Science Fairs, the Permanent Counsellor of the AJAS and the State Coordinator of Science Fairs will be in consultation.

3. The program of the regional meetings of the AJAS and the Regional Science Fair will consist of:
   a. The Regional Science Fair exhibits.
   b. Presentation of papers by senior high school students, with two papers from each region to be entered in state competition at the annual meeting of the AJAS.
   c. Business meeting.

4. At the regional meeting, each member chapter (senior high schools) will have two voting delegates which will participate in the business activities of the region for the entire chapter.

5. In order to permit participation in this program by junior high schools, associate chapters from junior high schools will be recognized by the Alabama Junior Academy of Science. The privileges and limitations of the associate chapters will be provided as follows:

a. They may participate in the activities of the regions only.
b. They may participate in the regional business meetings by having one voting delegate per chapter.
c. Members of associate chapters may not hold elective offices, but may be eligible for positions on regional committees.

6. The annual state-wide meeting of the Alabama Academy of Science and the AJAS should be held, if possible, not earlier than April 1 to permit the scheduling of the regional activities prior to that time. The program for the annual meeting of the AJAS should include:
   a. Exhibition of:
      1. The chapter project from each chapter for inter-chapter competition.
      2. Finalists' projects from the Regional Science Fair for display purposes.
      3. Gorgas Scholarship projects for display purposes.
   b. A joint program with the Alabama Academy of Science or one of its sections or both.
   c. Presentation of papers by the two winners from each region for judging.
   d. Business meetings of AJAS.
   e. Banquet, preferably a joint one with the Senior Academy.
7. The administration of the annual meeting of the AJAS will be by the committee of the counsellors of the several regions, the AJAS state officers, the sponsors of the AJAS state officers, and three counsellors elected by the Alabama Academy of Science which are to be the Permanent Senior Counsellor, the Local Arrangements Counsellor, the Exhibits and Judging Counsellor.

It is the opinion of the members of this sub-committee that these changes providing for regional divisions of the AJAS will accomplish the following:

1. Extend and stimulate interest in and activities of the AJAS.
2. Strengthen Regional Science Fair interest and activity.
3. Improve the overall quality of science activity of both junior and senior high school students.
4. Provide for stronger bonds between the AJAS and AAS.
5. Improve the total science training and participation effectiveness of the state AJAS.

Since it is probable that the Junior Academy business meeting this afternoon will also vote approval, it will soon be possible for various local science activities to be tied in with the Regional Fairs.

This should enable much improvement and expansion of high school science club work which was often not possible at the state-wide meeting. It must be emphasized here that the newly-authorized committees on Junior Academy and Science Fairs cannot themselves produce successful meetings. This is possible only with the devoted work of the sponsors coupled with the interest and ambition of the high school students. We in the Senior Academy should recognize this and lend every possible encouragement.

Often specialized advice and assistance is needed in formulating projects. This is the least we should be prepared to do, and the co-operation of the Engineers' Club of Birmingham has been assured by the offer of their Executive Secretary, Mrs. Inez Fuqua, to serve as a clearing agent for contacts between requests from teachers or students and professional men prepared to help.

Relationships of the Academy outside of its membership. It is generally recognized that improvement of science education in our high schools is of fundamental importance. Dr. William T. Wilks, as a member of this Long-Range Planning Committee and Chairman of the Science Education Committee, has been charged with exploring this important area.

THE ACADEMY AND SCIENCE EDUCATION

The continued interest of the Alabama Academy of Science in problems of science teaching and in the improvement of science instruction has been evidenced in many ways. The minutes of the general meetings, those of the Executive Committee, and actions of the Long-Range Planning Committee reveal a number of resolutions concerning science education. These resolutions deal primarily with conditions of teaching and with the need for strengthened instruction in the public schools. Presidential addresses have many references to the problem. Examples are those of President Emigh in 1949 entitled *Southern Research and Education,* President Basore in 1950 when he lists "support of education" as number one among suggested contributions of the Academy to the state, and more recently, President Howard Carr's address dealing with a survey of the offerings of Alabama high schools in science and mathematics. General symposia have been held in this area, such as the one on The Improvement of Science Teaching in Alabama in which Dr. Mayor of the AAAS participated in 1956, and the 1958 joint meeting with the Junior Academy to discuss *High School Science in Alabama.* Many discussions of science teaching have appeared in the Journal, (an outstanding example being Dr. Paul Bailey's re-

port on the training of Alabama High School science teachers in volume 28), and many discussions of the Science Education Section have been concerned with teaching problems.

Additional evidence of this interest is found in the support given by the Academy and its members to the Junior Academy of Science, to the Science Talent Search, the Gorgas speakers roster, and to the Gorgas Scholarship Foundation. In 1951 the Academy established the Academy Award for outstanding science teaching, the first recipient being Miss Kathryn M. Boehmer of Ensley High School. In 1954, Dr. Madison Marshall was appointed State Science Fair Chairman for the Academy and active support for regional science fairs has been given since this time.

In 1956 the importance of science instruction was recognized by the appointment of a standing committee on Science Education. Since then, this committee has contributed a considerable amount of time to investigations of teaching problems and has reported regularly to the Executive Committee and to the membership of the Academy. This committee has consistently dealt with problems on a constructive basis and the primary objective of its work has been the improvement of science and mathematics teaching, rather than negative criticism of the work of those outside the Academy who are also concerned with the training and performance of teachers. The services of this committee (and of the Academy) have been offered on many occasions to those involved in the training and certification of high school science teachers.

During the past year three main efforts have been initiated in line with this constructive objective. Primarily through the efforts of Dr. James Kassner (with the backing of the long-range planning committee, the Science Education Committee, and the Executive Committee), discussions have been held with representatives of the State Department of Education in which the cooperation of the Academy has been offered to public school systems in the selection of high school science equipment.

The Chairman of Science Education Committee (with endorsement of Executive Committee) has begun a series of conferences with State Department of Education officials in an attempt to bring together outstanding scientists, science teachers, and persons in professional education in a state-wide conference aimed at a re-examination of our science and mathematics teacher training program. One main objective of such a conference would be that of discussing on a face-to-face basis problems met in the education of teachers

in three areas: general education, professional education, and subject matter mastery. Such a discussion would be expected to result in a better understanding by all concerned with the importance of each phase of teacher education, and should produce concrete recommendations for the strengthening of science and mathematics teacher-training in Alabama.

The third approach to cooperative action by the Academy in the field of Science Education has been initiated by the Long-Range Planning Committee in its project request to the National Science Foundation for financial assistance in the use of voluntary speakers to supplement science instruction in Alabama and to provide said speakers with teaching kits to increase their effectiveness. While none of the above projects are in a state of final realization, they point a direction for Academy action in cooperative efforts aimed at the improvement of science teaching at both the secondary and college level.

With specific reference to certification requirements, I very much hope that Dr. Wilks, with the help of various interested and influential persons, will be able to set up a conference at which the aims of those primarily interested in education and those concerned about a more thorough subject matter background for teachers can be presented to each other. It is important that this be done in an atmosphere of mutual respect and desire to achieve the greatest amount of real gain in science instruction of the youth of Alabama. At present, there is a serious conflict between teacher certification requirements and inadequate teacher experience in science subject-matter.

As Dr. Wilks mentioned, Dr. James Kassner has been working toward building closer cooperation between the Academy and the State Department of Education, especially in the field of offering our special professional competence in consultation over such important subjects as the Federal matching funds for the purchase of supplemental equipment for science teaching in the high schools. A special Alabama Academy Committee has been set up under the chairmanship of Dr. John C. Blair, consisting of representatives of various areas in science instruction in the state. The talents and experience of this group should enable far more effective use of the funds reported to be available for purchase of school science equipment.

A considerable amount of activity during the summer and fall of 1958 was evoked by an invitation from the National Science

Foundation to submit a grant request for some project in the broad area of improvement of science and mathematics teaching. Although this work was carried out by a special committee under the guidance of Dr. Allen Tower, rather than this Long-Range Planning Committee, the possible impact of the idea worked out and submitted as a project for support is so great, it is included here.

SPECIAL COMMITTEE ON NATIONAL SCIENCE FOUNDATION GRANTS

To many of us the Alabama Academy of Science has been an organization whose annual meeting provided the opportunity for scientists to present papers, exchange ideas, and relax in the company of their peers. Valid as such an attitude may be, it is not enough. The current recognition of the critical need for improving the teaching of science and mathematics and for developing an increased number of competent scientists requires more purposeful activity on our part. We have a Junior Academy of Science and the Science Fairs, to which many of us have paid little attention. The Alabama Academy of Science must become more active.

It was with such views that we received news last summer from AAAS that the National Science Foundation expected funds to be available for grants for such work, and that local State academies were considered the proper vehicles for the work, in cooperation with other local scientific organizations. With representatives from the American Chemical Society and the Birmingham Engineering Council, we discussed plans for an Academy Executive Secretary who could serve to coordinate a program of science activities.

Subsequent information revealed that the National Science Foundation had more limited objectives. In conformity with this, a project was drawn up in collaboration with the Southern Research Institute to provide special lecture-demonstrations to high schools in the Birmingham area. It is proposed that the Institute will assign a qualified man one-third time as project director who, in consultation with an Academy committee, will assemble a series of lectures and kits, in mathematics, physics and engineering, chemistry, and biology. A panel of qualified speakers to use them will be secured. The project director will prepare speaking schedules for local high schools desiring this aid.

After a year's experience in the Birmingham area, it is hoped that this plan will be sufficiently successful to permit its extension to other areas of the State. National Science Foundation grants will

probably be sought for a second and a third year, but with the hope that sufficient success would permit local financing soon to take over the load. The Mobile Academy of Science has filed an application to support a comparable program.

If financing for this project should become available, even at less than the submitted amount, it should allow the Academy in conjunction with Southern Research Institute to bring a wealth of supplemental science demonstration material to the high schools of Birmingham-Jefferson County and later beyond this area. With science instruction itself on a more solid basis plus the extra student interest bound to be aroused by these special talks, we can dare to hope for a real upswing in eventual contribution of the youth of our state to understanding of science.

There are many other areas with a rich potential deserving exploration such as bringing wider and more authentic presentation of science to the non-science public through newspaper, radio and TV media. Many of our members are now doing valuable work along these lines sponsored by other organizations in the state, but the "saturation level" is a long ways off. Full use of our possibilities will depend upon more of you, as competent exponents, being interested in such presentations plus successful arrangements being worked out with these forms of public contact on a non-sponsored basis.

Time limitations this morning do not permit mentioning any more possibilities.

Summary. We have presented to you some of the lines of thought and action of your Academy Long-Range Planning Committee. Our pride in the unusual spectacle of some actual accomplishments, as in the case of broadening the base of operations of the Junior Academy onto a regional level, must clearly be tempered by the very tentative steps taken in other directions. Whether these steps falter or continue toward real progress depends upon the enthusiasm of the members of our Academy in being willing to participate. No group of officers, however devoted, can accomplish all that is desirable. Along with constructive criticism, I wish to bespeak your active help in making this genuinely Long-Range Planning.

S. B. Barker, chairman, on behalf of Paul C. Bailey, William J. Barrett, Reuben Boozer, J. R. Goetz, Mary Hafling, George C. Irons, Gibbes, Patton, William T. Wilks, Father Patrick Yancey, and ex-officio, James L. Kassner, Herbert A. McCullough, Father George O. Twellmeyer, James C. Wilkes.

ALABAMA ACADEMY OF SCIENCE

OFFICERS—1959-60

President .... Samuel B. Barker, University of Alabama Medical Center Birmingham

President-Elect .... James R. Goetz, 2021 6th Avenue N., Birmingham

VICE-PRESIDENTS, SECTION CHAIRMEN AND VICE CHAIRMEN

Section I

Biological Sciences .... Vice-President and Section Chairman, Robert A Dietz, Troy State College, Troy

Vice-Chairman, William Ivey, API, Auburn

Section II

Chemistry .... Vice-President and Section Chairman, Kenneth M. Gordon, Birmingham-Southern College, Birmingham

Vice-Chairman, Charles E. Feazel, Southern Research Institute, Birmingham

Section III

Geology and Anthropology.... Vice-President and Section Chairman, Earl L. Hastings, Geological Survey of Alabama, University

Vice-Chairman, David L. DeJarnette, Box 66, Moundville

Section IV

Forestry, Geography and Conservation .... Vice-President and Section Chairman, David E. Hampe, 200 Bonita Drive, Birmingham

Vice-Chairman, Vernon J. Knight, Coosa River Newsprint, Coosa Pines

Section V

Physics and Mathematics...... Vice-President and Section Chairman, R. E. Wheeler, Howard College, Birmingham

Vice-Chairman, L. J. Eisele, S. J., Spring Hill College, Mobile

Section VI

Industry and economics........ Vice-President and Section Chairman, John Baswell, 5613 10th Avenue S, Birmingham

Vice-Chairman, James Sulzby, Jr., 3121 Carlisle Road, Birmingham

Section VII

Science Education — Vice-President and Section Chairman, Lucille Lloyd, Prichard
Vice-Chairman, Jerome G. Kuderna, 157 Cary Drive, Auburn

Section VIII

Social Sciences — Vice-President and Section Chairman, E. C. Paustian, Athens College, Athens
Vice-Chairman, E. D. Chastain, API, Auburn

Section IX

Medical Sciences — Vice-President and Section Chairman, Thomas E. Hunt, University of Alabama Medical Center, Birmingham
Vice-Chairman, Roger W. Hanson, University of Alabama Medical Center, Birmingham

Secretary — Wilbur B. DeVall, Department of Forestry, API, Auburn

Treasurer — William J. Barrett, Southern Reseach Institute, Birmingham

Editor of Journal — Paul Bailey, Alabama College, Montevallo

Councilor of AAAS — Patrick H. Yancey, S. J., Spring Hill College, Mobile

Permanent Counselor of Junior Academy — James C. Wilkes, Jr., Huntingdon College, Montgomery

Associate Counselor of Junior Academy — Gid E. Nelson, Jr., Alabama College, Montevallo

Associate Counselor of Junior Academy — Reuben Boozer, State College, Jacksonville

Coordinator of Science Fairs — George O. Twellmeyer, S. J. Spring Hill College, Mobile

BOARD OF TRUSTEES

PROGRAM

THIRTY-SIXTH

ANNUAL MEETING

of the

Alabama Academy of Science

MARCH 13-14, 1959

ALABAMA POLYTECHNIC INSTITUTE

Auburn, Alabama

General Program

Thursday, March 12, 1959

6:30 P.M.—Informal Dinner for Executive Committee, Banquet Room, Auburn Union

8:00 P.M.—Executive Committee Open Meeting, Banquet Room, Auburn Union

Friday, March 13, 1959

7:00 A.M.—Breakfast, Union Cafeteria

8:00 A.M.—Registration, Thach Hall

9:00 A.M.—General Session, Thach Hall Auditorium, Herbert A. McCullough, Presiding

Welcome—Ralph B. Draughon, President, Alabama Polytechnic Institute

Introduction of Alabama Junior Academy of Science Officers and Sponsors—Reuben Boozer

Panel Discussion: "Thirty-Five Years of the Alabama Academy of Science — Where Have We Been and Where Are We Going?" (Report of the Long Range Planning Committee)—Samuel B. Barker, Moderator

10:30 A.M.—Section Meetings

I. Biological Sciences, Room 106, Tichenor Hall
II. Chemistry, Room 108, Thach Hall
III. Geology and Anthropology, Room 104, Thach Hall
VIII The Social Sciences, Room 210, Thach Hall
IX Medical Sciences, Room 208, Thach Hall

12:30 P.M.—Lunch—Union Cafeteria

2:00 P.M.—Section Meetings

I. Biological Sciences, Langdon Hall
II. Chemistry, Room 108, Thach Hall
IV. Forestry, Geography and Conservation, Room 202, Thach Hall
V. Physics and Mathematics, Room 108, Tichenor Hall
VII. Science Education, Room 204, Thach Hall
VIII. The Social Sciences, Room 210, Thach Hall
IX. Medical Sciences, Langdon Hall

3:45 P.M.—Section Meetings

I. Biological Sciences, Room 106, Tichenor Hall
IX. Medical Sciences, Room 208, Thach Hall

6:30 P.M.—Annual Dinner, Union Ballroom

Host: E. H. Sargent and Company
Birmingham Division

Program

Invocation .... Harold E. Wilcox
Appreciations .... Samuel B. Barker
Presidential Remarks .... Herbert A. McCullough
"Yesterday, Today and Tomorrow"

Saturday, March 14, 1959

7:00 A.M.—Breakfast, Union Cafeteria
8:30 A.M.—Annual Business Meeting, Thach Hall Auditorium
9:00 A.M.—Section Meetings
I. Biological Sciences, Room 106, Tichenor Hall
VIII. The Social Sciences, Room 210, Thach Hall
IX. Medical Sciences, Room 208, Thach Hall
9:00-10:30 A.M.—Display of Exhibits, Alabama Junior Academy of Science, Room 106, Biggin Hall
11:00 A.M.—Joint General Meeting, Alabama Academy of Science and Alabama Junior Academy of Science, Langdon Hall
Herbert A. McCullough, Presiding
Presentation of Speaker—Samuel B. Barker
Address: "People as Biological Individuals" Roger J. Williams, Professor of Chemistry and Director of Clayton Foundation Biochemical Institute, University of Texas

Gorgas Scholarship Foundation

Thursday, March 12, 1959

Selection of Winners of Alabama State Science Talent Search for General Gorgas Scholarships
5:00 P.M.—Demonstration of exhibits to judges, Tichenor Hall
6:00 P.M.—Banquet for finalists and judges, Union Building
7:30 P.M.—Personal interviews of finalists with judges, Tichenor Hall

Alabama Junior Academy of Science

Friday, March 13, 1959

9:00 A.M.-12:00 Noon—Registration of members and of exhibits and papers, Biggin Hall
10:00 A.M.-12:00 Noon—Preparation of exhibits, Room 106, Biggin Hall
10:30 A.M.—A. Caucus of officers and official delegates, Langdon Hall
B. Conference of sponsors and AJAS counselor, Biggin Hall
12:00 Noon—Lunch, Union Cafeteria

1:00 P.M.—Business Meeting, Langdon Hall
2:00 P.M.—A. Joint meeting with Sections I and IX of the Senior Academy, Langdon Hall
B. Tours
4:00 P.M.—Judging of exhibits. (Exhibits closed during judging. Exhibitors are to be on call in Biggin Hall for interviews with judges.)
7:00 P.M.—Annual Banquet, Union Cafeteria. Address by retiring president Theresa Hagendorfer
Presentation of Alabama Academy of Science Award
Announcements of finalists in judging of scientific papers
Announcement of winners in Alabama State Science Talent Search
9:00 P.M.—Party, Union Ballroom.

Saturday, March 14, 1959

8:00-12:00 Noon—Display of exhibits, Room 106, Biggin Hall
8:30 A.M.—General assembly for presentation of scientific papers by finalists, Langdon Hall
9:30 A.M.—Business Meeting, Langdon Hall. Election of officers for 1959-60
Treasurer's Report
Presentation of awards for papers and for exhibits
Presentation of AAAS Awards
11:00 A.M.—Joint meeting with Senior Academy, Langdon Hall
12:00 Noon—Adjournment, Langdon Hall
12:30 P.M.—"Dutch treat" luncheon, old and new Executive Committees, Union Cafeteria

Section Meetings

10:30 A. M., Friday, March 13, 1959

SECTION I, BIOLOGICAL SCIENCES

James C. Wilkes, Jr., Chairman
Room 106, Tichenor Hall

1. **Fossil Vertebrates of Vero, Florida.**
   Robert F. Weigel, Howard College.
2. **Some Helminth Parasites from an Alabama Rabbit.**
   Emmett W. Price, Jacksonville State College.
3. **A Dispersal Mechanism in Mites**
   Clarence C. Hall, Jr., Howard College

4. **The Genetical Relationships of Two Chorus Frogs of the Genus, PSEUDOACRIS.**
John S. Mecham, Alabama Polytechnic Institute.
5. **Embryonic and Juvenile Stages of the Japanese Quail.**
William D. Ivey and Carol S. Padgett, Alabama Polytechnic Institute
6. **Gonadal Histogenesis of the Coturnix Quail**
Carol S. Padgett, Huntingdon College, and William D. Ivey, Alabama Polytechnic Institute.
7. **Business Meeting.**

SECTION II, CHEMISTRY

E. L. Grove, Chairman
Room 108, Thach Hall

1. **The Infra-Red Spectra of Fused Potassium Pyrosulfate Melts and Fused Niobium Pentoxide—Potassium Pyrosulfate Melts in the 2-15.5 Micron Region.**
James E. Land, Alabama Polytechnic Institute.
2. **Syntheses in the Quinoline Series: Some Derivatives of 8-Chloro-6-ethylquinoline.**
William T. Tucker and Julius D. Capps, Alabama Polytechnic Institute.
3. **Syntheses in the Quinoline Series: Some Derivatives of 6-Bromo-8-ethylquinoline.**
James G. Beasley, Alfred D. Brown, Jr. and Julius D. Capps, Alabama Polytechnic Institute.
4. **Some Experimental Results of Sawdust Pulping.**
Helen Chao-Wu and Karl Lauer, University of Alabama.
5. **The Test for Aluminum in Qualitative Analysis.**
Edwin O. Price, Alabama Polytechnic Institute.
6. **Business Meeting.**

SECTION III, GEOLOGY AND ANTHROPOLOGY

William J. Powell, Chairman
Room 104, Thach Hall

1. **Coal Reserve Estimates on a Regional Basis.**
Reynold Q. Shott, University of Alabama.
2. **Fort Payne Chert—Warsaw Limestone Contact in Limestone County, Alabama.**
T. W. Daniel, Jr. and Earl L. Hastings, Geological Survey of Alabama.

3. **Natural Resources of Alabama for Defense.**
   Hugh D. Pallister, Geological Survey of Alabama.
4. **Burial Urn Site at Fosters, Alabama.**
   David L. DeJarnette, University of Alabama.
5. **Water Level Fluctuations in Observation Wells in Madison County, Alabama.**
   Thomas H. Sanford, Jr., U. S. Geological Survey, Water Resources Division, Ground Water Branch
6. **Business Meeting.**

SECTION VIII, THE SOCIAL SCIENCES

George V. Irons, Chairman
Room 210, Thach Hall

1. **Changing Personnel Practices in the Textile Industry.**
   H. Ellsworth Steele, Alabama Polytechnic Institute.
2. **Sociology, Social Change and Value.**
   Chester W. Hartwig, Alabama Polytechnic Institute.
3. **Social Science and the American Future.**
   James F. Doster, University of Alabama.
4. **Self-Evaluation and Intensity of Attitude.**
   Jean Dedman, University of Alabama.
5. **The Sack and Occupation of Athens, Alabama During the War Between the States.**
   Loraine Pabst, Athens College.
6. **Implications of Property Transferal Arrangements to Agricultural Efficiency in the Black Belt Region of Alabama.**
   E. D. Chastain, Alabama Polytechnic Institute.

SECTION IX, MEDICAL SCIENCES

Alan Hisey, Chairman
Room 208, Thach Hall

1. **Myocardial Lesions in Rats Maintained on Diets Deficient in Choline.**
   P. M. Newberne and W. D. Salmon, Alabama Polytechnic Institute.
2. **Effects of Choline Deficient Diets with Various Supplements on Nucleic Acid Content of Rat Livers.**
   Preston T. Farish and W. D. Salmon, Alabama Polytechnic Institute.
3. **Effects of Ethionine and Triethylcholine on Rats Receiving Choline Deficient Diets.**

W. D. Salmon, Alabama Polytechnic Institute.

4. **Self-chosen Diets During Pregnancy and Health of the Newborn Infants for a Group in Birmingham, Alabama.**
Bessie L. Davey and Lorene G. Smith, University of Alabama.

5. **Lipolytic Activity of Subcellular Fractions of Rat Pancreas.**
Paul Melius, Alabama Polytechnic Institute.

6. **Business Meeting.**

2:00 P. M., Friday, March 13, 1959

JOINT MEETING

Setion I, Section IX and Alabama Junior Academy of Science
Auditorium, Langdon Hall

James C. Wilkes, Jr., Chairman; Alan Hisey, Co-Chairman

1. **Astronautics: A Survey of the Achievements, Problems, and Probable Future of Space Travel.**
James A. Fraser, Air University, Montgomery.

2. **Astronautics: A Discussion of the Environmental Factors Which Will Pose Problems for Manned Space Travel, and Some Possible Solutions.**
Lt. Col. Don Peters, M. D., Air University, Montgomery.

SECTION II, CHEMISTRY

Kenneth M. Gordon, Acting Chairman
Room 108, Thach Hall

1. **The Role of the D-C Analog Computer in Physical Chemistry.**
R. E. Littleton and R. E. Wingard, Alabama Polytechnic Institute.

2. **Attempts at the Synthesis of Sialic Acid.**
Wolfang Roth, University of Alabama Medical Center.

3. **The Reactions of Niobium Oxychloride with Menthanol and Ethanol.**
Patrick M. Hicks, LaGrange College and James E. Land, Alabama Polytechnic Institute.

4. **Oxidation of Diphenylamine in Acetic Acid-Sulfuric Acid Mixtures.**
O. L. Hurtt, Birmingham-Southern College.

5. **An Extrapolation Procedure for Determining Solubility.**
William B. Bunger, Alabama Polytechnic Institute.

6. **The Application of a Chemical Buffer to the Flame Photometric Determination of the Alkali Elements.**
Thomas Smart and E. L. Grove, University of Alabama.

SECTION IV, FORESTRY, GEOGRAPHY AND CONSERVATION

William B. Black, Chairman
Room 202, Thach Hall

Program Theme: "A Look at the Forest Resource in Alabama's Piedmont."

1. **Alabama's Piedmont: A Geographical View.**
   J. Allen Tower, Birmingham-Southern College.
2. **Progress in Soil, Water, and Woodland Conservation in Alabama's Piedmont.**
   O. C. Medlock, State Conservationist, Soil Conservation Service.
3. **Timber Resources of Alabama's Piedmont.**
   William R. Sizemore, William R. Sizemore & Company, Tallassee.
4. **Lumbering in Alabama's Piedmont.**
   Cecil Duffee, Jr., Dadeville Lumber Company, Dadeville.
5. **Role of the Pulp and Paper Industry in Alabama's Piedmont.**
   Gordon Comer, District Forester, Coosa River Newsprint Company.
6. **The Wildlife Resource of Alabama's Piedmont.**
   Earl F. Kennamer, Fish and Wildlife Specialist, Alabama Extension Service.
7. **Southern Fusiform Rust on Slash Pine Planted in the Alabama Piedmont.**
   George I. Garin, Alabama Polytechnic Institute
8. **Business Meeting.**

SECTION V, PHYSICS AND MATHEMATICS

L. P. Burton, Chairman
Room 108, Tichenor Hall

1. **Some Unusual Lemniscates.**
   Roland M. Harper, University of Alabama.
2. **A New Geometry Proposition Demonstrated.**
   J. F. Duggar, Jr., Hope Hull, Alabama.
3. **The Measurement of Instanteous Velocity of Pulsatile Fluid Flow.**
   W. H. Bancroft, Jr., Howard College.
4. **Mathematics in Latin American Universities.**
   W. L. Furman, S. J., Spring Hill College.
5. **Strain-rate Effects**
   Paul Budenstein, Alabama Polytechnic Institute.

6. **Design of an Electrometer Amplifier.**
Jack W. Crenshaw, Alabama Polytechnic Institute.
7. **Rational Approximation of Real Functions**
Daniel E. Dupree, Alabama Polytechnic Institute.
8. **Speculations on the Origin of the Gegenschein (Counterglow).**
Earl T. Kinzer, Alabama Polytechnic Institute.
9. **On the Group of Type P Infinity.**
Paul Hill, Alabama Polytechnic Institute.
10. **Business Meeting.**

SECTION VII, SCIENCE EDUCATION

Paul J. Arnold, Chairman
Room 204, Thach Hall

1. **A Full-Time State Director of Science Fairs for Alabama.**
Dorwin L. Kilbourn, Alabama Polytechnic Institute.
2. **Discussion and Questions.**
3. **Some Additional Suggestions for Improving Science Teaching.**
Blanche E. Dean, Woodlawn High School, Birmingham.
4. **The Inservice Training of Teachers of General Science Classes.**
Jerome Kuderna, Alabama Polytechnic Institute.
5. **Discussion of Topics 3 and 4.**

SECTION VIII, THE SOCIAL SCIENCES

E. C. Paustian, Acting Chairman
Room 210, Thach Hall

1. **Opportunity Recognition in Managerial Adjustment in Alabama Agriculture.**
John E. Lee, Jr., and E. D. Chastain, Alabama Polytechnic Institute.
2. **The "New States" Issue in Nigerian Federalism.**
Grady H. Nunn, University of Alabama.
3. **Major and Minor Programs in the Teaching of Sociology in Alabama Colleges, 1957-58.**
Harry Dickinson, Howard College.
4. **Some Statistical Indices of Culture.**
Roland M. Harper, University of Alabama.
5. **The Commonwealth Parliamentary Association: A Political Institution of the Commonwealth of Nations.**
Frederic D. Ogden, University of Alabama.
6. **Business Meeting.**

3:45 P. M., Friday, March 13, 1959

SECTION I, BIOLOGICAL SCIENCES

Robert Dietz, Acting Chairman
Room 106, Tichenor Hall

1. **The Sweet Gum Industry in Clarke County and Future Potentialities.**
   George M. Hocking, Alabama Polytechnic Institute.
2. **Reserpine Inhibition of 3,3,5-Triiodothyronine Treated Rats.**
   Kenneth Ottis, Alabama Polytechnic Institute.
3. **The Cytology of an Ascites Tumor.**
   Michael Mahan, Alabama College.
4. **Some Notes of the Cytology of a Mouse Tumor—Sarcoma I Ascites.**
   Darrol Pharris, Alabama College.
5. **A Plea for More Seed Testing.**
   Marion Viccars, Montgomery
6. **Antagonism Among Microorganisms Isolated from White Clover.**
   James D. Hansen, Alabama Polytechnic Institute.

SECTION IX, MEDICAL SCIENCES

Alan Hisey, Chairman
Room 208, Thach Hall

1. **Pharmacy Schools in Alabama.**
   Emmett B. Carmichael, University of Alabama Medical Center.
2. **Antithyroxine Effect of Some Thyroxine Analogs.**
   C. S. Pittman and S. B. Barker, University of Alabama Medical Center.
3. **Amino Acid Changes after Incubation of Rat Kidney Cortex in the Presence of Thyroxine.**
   R. H. Lindsay, Nicole Etling and S. B. Barker, University of Alabama Medical Center.
4. **An "in vitro" Effect of Thyroxine on Gluconeogenesis.**
   R. W. Hanson, R. H. Lindsay and S. B. Barker, University of Alabama Medical Center.

9:00 A. M., Saturday, March 14, 1959

SECTION I, BIOLOGICAL SCIENCES

Robert Dietz, Acting Chairman
Room 106, Tichenor Hall

1. **Chemical Changes in Peanuts Resulting from Various Species of Storage Fungi.**

H. S. Ward, Jr., Alabama Polytechnic Institute.

2. **Fungicidal Control of Bacterial Spot of Peach in Alabama in 1958.**
Urban L. Diener, Alabama Polytechnic Institute.
3. **Disease Development from Seed-borne infection in Gummy Stem Blight in Watermelons.**
Urban L. Diener, Alabama Polytechnic Institute.
4. **Heliotropic Movements in SIDA RHOMBFOLIA.**
Roland M. Harper, University of Alabama.
5. **Mosquitos from Lee Country, Alabama.**
William C. Bargren, Alabama Polytechnic Institute.
6. **Some Observations on an Unusual Physiological Display of a Brood of Western Ground Snakes with Notes on Parturition.**
James E. Keeler, Alabama Department of Conservation.
7. **A Little Blue Heron Nesting Population.**
Julian L. Dusi, Alabama Polytechnic Institute.
8. **The Southeastern Shrew in Alabama.**
Julian L. Dusi, Alabama Polytechnic Institute.

SECTION VIII, THE SOCIAL SCIENCES

George V. Irons, Chairman
Room 210, Thach Hall

1. **The Legal Delinquent: A Comparative Study.**
Alan J. Shields, Alabama Polytechnic Institute.
2. **Alabama Freedman's Hospital at Talladega.**
Hugh C. Bailey, Howard College.
3. **Title to be Selected.**
Marion W. Spidle, Alabama Polytechnic Institute.

Remaining period for the reading and discussion of additional papers and critique of papers previously read.

SECTION IX, MEDICAL SCIENCES

Alan Hisey, Chairman
Room 208, Thach Hall

1. **Evaluation of Hemopoietic Effects and Inhibition of Mouse Sarcoma 180 in Young Mice: The Effects of Bis-Mesylates Related to Myleran.**
Wayne H. Finley and J. W. Woods, University of Alabama Medical Center.

2. **The Influence of Glucagon on Sugar Distribution in the Rat.**
Robert W. Longley, University of Alabama Medical Center.

3. **Blood Volume Studies in Rheumatoid Arthritis.**
W. E. Martindale, W. L. Hawley, H. L. Holley and W. J. Wingo, University of Alabama Medical Center.

4. **A Micro Pipette for Paper Chromatography and Electrophoresis.**
Walter H. Johnson, University of Alabama Medical Center.

5. **Electrophoretic Separation of Mixtures of Galactose and Lactose.**
Walter H. Johnson, University of Alabama Medical Center.

6. **Immunologic Treatment of Cancer.**
Eric R. Brown, University of Alabama.

7. **Pelvic Splanchnic Nerves of the Male Rhesus Monkey.**
H. N. Schnitzlein, H. H. Hoffman, and M. B. Quigley, University of Alabama Medical Center.

8. **The Occurrence of Glycogen in the Adrenal Cortex of the Rat under Different Experimental Conditions.**
Thomas E. Hunt and Eleanor Hunt, University of Alabama Medical Center.

ALABAMA ACADEMY OF SCIENCE EXECUTIVE COMMITTEE MEETING

Room 201, Biology Building, Howard College
Birmingham, Alabama, November 8, 1958

President Herbert A. McCullough called the meeting to order at 10:00 a.m.

The following members were introduced by the Secretary: William Barrett, James Wilkes, E. L. Grove, William Wilks, J. R. Goetz, Herbert McCullough, Samuel Barker, Father Patrick Yancey, Reuben Boozer, Gibbes Patton, Paul Arnold, Paul Bailey, Alan Hisey, J. Allen Tower, William Black, James Kassner. Visitors and members arriving later were: John Fincher, Father Twellmeyer, Thomas Hunt, George Irons, and James Sulzby.

The minutes of the Executive Committee meeting of March 31, 1958, were distributed. Mr. Goetz moved the approval of the minutes as mimeographed. Dr. Barker seconded, and the *minutes were approved.*

The *Report of the Secretary and the Admission to Membership Committee* was given. (Copy attached) (Summary of report: Twenty-five new members have been added to the roll of the Academy. At least seven resignations have been received because of moving out of the state and the inability to attend meetings. The Secretary was out of his office for four months in the summer, which resulted in a backlog of mail as well as some embarrassment to the Academy. Mail is now being handled as it arrives. An up-to-date mailing list before the next general mailing is the aim of the Secretary. The following recommendation was made: In recognition of long-term devotion to activities of the Alabama Academy of Science, the Admission to Membership Committee recommends the election of Dr. James L. Kassner and Father Patrick H. Yancey for Honorary Membership in the Academy.) Dr. Kaylor moved and Dr. Barker seconded the approval of the report. Unanimously, the *report was approved,* and Dr. Kassner and Father Yancey were elected to honorary membership.

Dr. William Barrett gave the *Report of the Treasurer.* (Copy attached) (Summary of report: There is a balance of $2,598.71 of which $370.00 is in the Research Fund as of November 3, 1958. The Academy's status as a tax-exempt corporation is still before the Commissioner of Internal Revenue.) Dr. Wilkes moved the approv-

al of the report. Upon a second by Dr. Bailey, and a vote of the members, the *report was approved.*

The *Report of the Editor of the Journal* was given informally by Dr. Paul Bailey. (Summary of Report: The first issue of the quarterly journal is out. The second quarterly number will be out in a very short time.)

> *MOTION:* By Dr. Barker, seconded by Dr. Hisey and many others. The Editor's report be accepted and the Editor commended for the smooth transition from an annual publication to a quarterly publication. *Motion passed* and the *report of the Editor accepted.*

The *Report of the Editorial Board* was read by Dr. Barrett in the absences of Dr. Locke White, Jr. (Copy attached) (Summary of report: The board has no action to report. The editor of the journal is continuing to do an outstanding job.) Dr. Arnold moved, Dr. Patton seconded, and the members voted *approval of the report.*

There was no *Report of the Research Committee.*

The *Report of the Membership Committee* was given by Dr. Barker. (Copy attached) (Summary of report: A determined effort should be made to keep our collegiate membership alive. Members of the Executive Committee should also consider themselves members of the membership committee, and the chairman urges them to contact possible new members.) Mr. Goetz seconded Father Yancey's motion for *approval* and it *was so voted.*

The *Report of the Long-Range Planning Committee* was given by Dr. Tower. (Summary of report: In a series of meetings of the committee, work was done to draft a proposal to the National Science Foundation to secure finances for a full-time director in the state for the program of betterment of science education. The latest communication from the NSF, 10 days before the meeting of the Executive Committee, states that they will not finance this type program. In an exploratory fashion, the committee has considered the idea of a Speaker's Bureau working out of Birmingham, to talk to science classes in near vicinity of Birmingham). Dr. Bailey moved and Dr. Fincher seconded the approval of the report. In the following discussion, Dr. Kassner recalled that there had been a speakers list compiled by the Gorgas Scholarship Foundation who might be called upon to speak to science classes and he suggested coordination of the two speakers' bureaus. Dr. Wilks noted that the action proposed by the LRPC was in the realm of the Science Education Committee, and that the science Education Committee should

be kept informed. Dr. Tower stated that the overlap really occurred after the reversal of policy by the NSF. His committee in its meeting on November 1, 1958, had explored the idea of a speaker's bureau, and he regretted that the Chairman of the Science Education Committee had not been informed. It was not an intentional oversight, but due to the short interval of time elapsed between the meeting of the LRPC and the Executive Committee Meeting. Upon a call for question, the *report was approved.*

ACTION BY THE PRESIDENT:

President McCullough dissolved the present Long-Range Planning Committee. This committee, consisting of Drs. Fincher, Walker, White, Gordon, and Tower as chairmen, is henceforth a special committee on National Science Foundation grants, and it is to work with any of the standing committees into whose realm it may enter as it conducts its studies.

President McCullough appointed as the Long-Range Planning Committee a new committee with Dr. Samuel Barker as chairman. This committee is to re-evaluate the place of the Academy in our present-day society, and is to explore the direction in which the Academy should apply its efforts so that the Academy can accomplish or render the most effective service.

There was no *Report of the Finance Committee.*

The *Report of the Councilor to the AAAS* was given by Father Yancey. (Copy attached) (Summary of report: There has been no meeting of the AAAS since the Executive Committee last met. The Councilor will attend the AAAS conference of December 28, 1958. He outlined the purpose of the conference). Dr. Arnold moved and Dr. Barrett seconded approval of the report. Upon voting, the *report was approved.*

Mr. Boozer gave the *Report of the Counselor of the AJAS.* (Copy attached) (Summary of the report: 1. The meeting of the AJAS should be held at the same time as the meeting of the Senior Academy this year. 2. The present counselors request that efforts be continued to secure a permanent counselor. 3. The Senior Academy should consider affiliating the AJAS with National Science Fairs of America and award the two winners of the exhibits at the AJAS meeting expense-free trips to the national competition. 4. The Career Symposium by Sections I and IX of the Senior Academy was welcomed as a feature of the tentative program of the AJAS. 5. The Senior Academy present complimentary copies of the journal to officers and sponsors of chapters affiliated with the AJAS. 6. The

Senior Academy consider developing a closer relationship between the AJAS and the Science Division of The Alabama Education Association.) Dr. Barker moved and Dr. Kassner seconded approval of the report as a whole. The president asked for discussion. Dr. Kassner observed that the number attending the AJAS meeting is quite large. Not all places that invite the Senior Academy have facilities to take care of the AJAS adequately. A survey should be made to see what places can handle the AJAS meeting. The possibility of separate meetings of AJAS and AAS must be considered. Dr. Barker commented that he would not like to see separate meetings unless at least the officers of the Senior Academy could attend. Senior Academy interest in the AJAS would lag unless the meetings are at the same time. Dr. Tower recalled that the officers cannot attend meetings of the AJAS when the meetings are concurrent because of their official duties. Separate meetings may have merit. President McCullough stated that it was his present plan to try to attend at least one meeting of the AJAS. Dr. Patton said sometimes there might be joint meetings depending upon the site of the Senior Academy meeting. Dr. William Wilks urges the exploration of the possibility of regional meetings of the AJAS. This would reduce the number in attendance at any one meeting. Mr. Goetz felt that the number of times that science exhibits were held was too frequent, with the same exhibitor showing in some three or four exhibits. Father Twellmeyer was in agreement with Professor Wilks' idea. He further proposed the holding of an Annual State Meeting with delegates from each of the Regional Meetings attending. Only the Regional Meetings would be attended by AJAS members. Father Yancey also supported Dr. Wilkes' proposal.

In regard to the second item of the report, President McCullough stated that he had an announcement following action in regard to the report.

> *AMENDMENT*: By Dr. Tower seconded by Dr. Arnold.
> Action on Item 3 be postponed to the meeting of the Long-Range Planning Committee, and a report given to the Executive Committee. *Amendment carried.*

> *AMENDMENT:* By Dr. Barker seconded by Mr. Goetz.
> In regard to Item 5, the Senior Academy shall present complimentary senior membership to sponsors of high school chapters of the AJAS effective immediately. *Amendment passed.*

Upon a call for question, the *report was approved.*

President McCullough announced the appointment of Dr. James Wilkes as permanent counselor pro tem, to work this year with the present counselors. Professor Wilkes of Huntingdon College will be nominated as permanent counselor at the annual meeting.

President McCullough announced that *Report of the Coordinator of Science Fairs* would be postponed and taken up under new business.

The *Report of the Cooperator with Science Clubs of America* was given by Dr. Kassner. (Copy attached) (Summary of report: a double postcard was mailed to all high schools. The high schools could use one half of the postcard to mail to Washington the name of the person at each high school to whom information regarding Science Fairs and Science Clubs should be sent.) Dr. Tower moved, Mr. Black seconded, and the members voted *approval of the report.*

Dr. Williams Wilks read the *Report of the Science Education Committee.* (Copy attached) (Summary of report: Through correspondence, the chairman proposed four questions to members of his committee in regard to (1) training of high school and elementary science teachers, (2) the master's program for high school and elementary science teachers (3) a conference to discuss training needed by science teachers, and (4) assistance that Academy could give directly to public schools to strengthen science teaching. The concensus of the answers is given in the report and the committee will continue to work on these questions.) Dr. Bailey moved, Father Yancey seconded approval of the report. *Approval was so voted.*

The *Report of the Editor of the Newsletter* was given by the Secretary. (The report: the newsletter has been published and mailed.) Mr. Boozer moved and Professor Grove seconded approval of the report. There was no discussion. The members signified *approval of the report* by their vote.

There was no formal *Report of the Public Relations Committee.* Mr. Goetz stated that he was looking forward to the meeting of the new Long-Range Planning Committee before making a formal report.

President McCullough reported on correspondence with the Chairman of *the Historical Committee.* Mr. Cantrell, chairman of this committee, feels that the History of the Alabama Academy of Science should be a separate publication of the Academy rather than an issue of the Journal. President McCullough said that he

would welcome a motion as to whether the History should appear as one or more numbers of the Journal or whether it should be a separate publication.

MOTION: By Dr. Barker seconded by Mr. Goetz.

It is the opinion of the Executive Committee that the History of the Alabama Academy of Science should be a separate publication of the Academy and the chairman of the Finance Committee be vested with the responsibility of financing this publication.

Mr. Goetz noted that the easiest method of financing would be to charge each member with the cost of his copy. He felt sure that each member would be willing to bear this expense. Upon a call for question, the *motion passed* unanimously.

Mr. Sulzby invited all attending the Executive Committee Meeting to lunch at the college cafeteria as his guests. There were no dissenting votes.

President McCullough gave the *Report of the Committee on Place-and-Date of Meeting* as sent to him by Dr. Howard Carr, chairman. (Summary of report: The next annual meeting of the Academy will be held on the campus of Alabama Polytechnic Institute. The proposed dates of meeting are March 12-14, 1959.)

MOTION: By Dr. Tower seconded by Dr. Hisey.

These dates be so established by the Executive Committee. *Motion passed.*

President McCullough *Reporting* for Dr. Wilbur DeVall, Chairman of *the Local Arrangements Committee,* stated that the committee has worked with more efficiency than any in his experience. At the present time, essentially all of the plans for the meeting have been completed.

President McCullough called for NEW BUSINESS.

1. A new Long-Range Planning Committee has been appointed. There is a great field for them to explore, and Dr. Barker has taken over very efficiently and capably.

2. Dr. Barker has been asked to present, in the form of a symposium at the annual meeting, a report of the work of the committee to the entire Academy. President McCullough stated that traditionally the Executive Committee gave approval to the topic of the opening symposium and he would entertain a motion in that regard.

MOTION: By Dr. Arnold seconded by Dr. Barrett.

Dr. Samuel Barker will be given the responsibility of plan-

ning and presenting the opening symposium at the annual meeting in 1959. *Motion passed.*

3. Deadline for call for papers.

MOTION: By Dr. Barker seconded by Dr. Tower.
February 1, 1959, shall be the deadline for titles of papers to be received by section chairman. *Motion passed.*

4. Stimulation of interest in Student Research Awards: There is much need for publicity to be given this portion of the Academy program.

5. Science Fairs: Dr. Beindorff, because of administrative duties, can no longer serve as Coordinator of Science Fairs. President McCullough read a Suggested State Level Organization of Science Fairs submitted to him in the form of resolution.

Resolution:

1. WHEREAS, the Alabama Academy of Science has undertaken the sponsorship of regional science fairs in the State of Alabama at the suggestion of the Oak Ridge Institute of Nuclear Studies of the Atomic Energy Commission, and
WHEREAS, the rapid growth of the regional fairs in Alabama has proven their worth as a means of increasing interest in mathematics and science as an aid to teaching, and
WHEREAS, the Alabama Academy of Science, recognizing the worth of the science fair movement, wishes to establish its sponsorship of the regional science fairs on a firmer and more permanent basis,

   BE IT RESOLVED, that the State Coordinator be the ex-officio Chairman, and the Regional Coordinators of the various regions, as provided hereafter, be the ex-officio members of the Committee on Regional Science Fairs, and further,
BE IT RESOLVED: that the Alabama Academy of Science establish a standing committee on Regional Science Fairs.

2. Whereas, it is the purpose of the Alabama Academy of Science in its sponsorship of regional science fairs to provide the conditions within the region which are necessary for and conductive to the successful organization, financing and operation of the regional fair, and
WHEREAS, the growth of the regional fairs indicates that this purpose can best be achieved by investing responsibility for the regional fair in the institutions of higher learning within the region,
BE IT RESOLVED: that the sponsoring institutions of higher

learning or other co-operating institution in the several science fairs regions be designated coordinating institutions with the responsibility of organizing, financing, and operating the regional fair in their respective regions, and, further,

BE IT RESOLVED: that a trusteeship be established to receive contributions and to provide for the financing of the regional fair in each designated region, and, further,

BE IT RESOLVED: that, in regions with a single coordinating institution, the above-mentioned responsibility is to be discharged through the Regional Coordinator who is to be appointed by the State Coordinator on recommendation of the coordinating institution, and, further,

BE IT RESOLVED: that, in regions with two or more coordinating institutions, the above-mentioned responsibility is to be discharged through a regional science fair committee on which the coordinating institutions are to be severally represented, the members of which committee are to be trustees of the region and are jointly to nominate the Regional Coordinator for appointment by the State Coordinator; the said Regional Coordinator is to be the ex-officio Chairman of the regional science fair committee.

3. WHEREAS, the Alabama Academy of Science considers it a necessary condition for the successful operation of a regional fair that the coordinating institutions and the regional coordinators have the greatest possible liberty that is in accord with its sponsorship.

   BE IT RESOLVED, that each regional fair be autonomous except as herein provided and with the following provisions:

   a. Each Science Fair Region is recommended to maintain a contract with the National Science Fair;
   b. Each regional fair is to be in conjunction with an institution of higher learning;
   c. All promotional material should recognize all agencies or institutions sponsoring regional fairs, including the Alabama Academy of Science;
   d. Each Science Fair Region must conform to the rules, regulations, and norms of the National Science Fair;
   e. Each Science Fair Region must conform to such general policies pertaining to all regional fairs as the Committee on Regional Science Fairs shall determine. These policies are subject to review by the Executive Com-

mittee of the Alabama Academy of Science on appeal by a coordinating institution;

f. The Regional Coordinators are to make an annual report on the condition of their respective regions to the Committee on Science Fairs.

Dr. Barrett moved and Father Yancey seconded adoption of the resolution. The amended *resolution was adopted* by a vote of the members.

President McCullough ruled that in the absence of a Coordinator that the Executive Committee has the power to elect a State Coordinator of Science Fairs to serve until the annual meeting. He opened the floor for nominations to this office. Dr. Barker nominated Father Twellmeyer of Spring Hill College.

MOTION: By Dr. Tower seconded by Mr. Goetz.

The nominations are closed and the Secretary is instructed to cast the ballot for Father Twellmeyer. *Motion passed.*

6. Dr. Wilkes stated that Mr. Jack Brown, Vice-Chairman of Section I, had resigned, and submitted the name of Professor Robert Deitz, of Troy State College to serve as Vice-Chairman. Dr. Arnold moved that the nominations be closed and *Robert Deitz was elected Vice-Chairman of Section I.*

7. President McCullough entertained the final motion, made by many and seconded by those remaining, and the meeting was adjourned at 12:35 p.m.

Respectfully submitted,

Hoyt M. Kaylor, Secretary

ALABAMA ACADEMY OF SCIENCE
EXECUTIVE COMMITTEE MEETING

Banquet Room, Union Building, Alabama Polytechnic Institute
Auburn, Alabama, March 12, 1959

President-elect Samuel B. Barker called the meeting to order at 8:10 p.m.

The following members were introduced by the Secretary: Samuel Barker, William Black, J. R. Goetz, William Wilks, Father Patrick Yancey, Howard Carr, Paul Bailey, Carl Sensenig, Alan Hisey, George Irons, Reuben Boozer, Emmett Price, Paul Arnold, Father George Twellmeyer, James Wilkes, L. P. Burton, E. L. Grove, William Barrett, Wilbur DeVall, Clyde Cantrell, James

Kassner, J. Allen Tower. Visitors and members arriving later were: President Herbert A. McCullough, Mrs. James Kassner.

The minutes of the Executive Committee Meeting of November 8, 1958 were distributed. Dr. Tower moved and Dr. Grove seconded that the minutes be approved as mimeographed. *The minutes were approved.*

President McCullough returned from a TV interview and assumed the chair.

The *Report of the Local Arrangements Committee* was called for by President McCullough. Before Professor DeVall gave the report, President McCullough praised the work of this committee and expressed his personal appreciation for the excellent manner in which the committee had provided for the Academy. (Summary of report: The committee carried out the wishes of the President in providing for publicity for the annual meeting. Coverage of the meeting by TV, radio, and press was arranged for. A good working staff had developed a master plan that could be used in later years by other local arrangement committees.) *The report was accepted* as presented.

The *Report of the Councilor to AAAS* was given by Father Yancey. (Copy attached.) (Summary of report: Father Yancey gave a resume of the meeting and of the Academy Conference.) Dr. Tower moved and Father Twellmeyer seconded approval of the report. Upon voting, *the report was approved.*

There was no *Report of the Editor of the Newsletter.*

There was no *Report of the Committee on Public Relations.*

The *Report of the Research Committee* was given by Dr. Sensenig. (Copy attached) (Summary of report: There have been four applications for funds for research. Two of these applications have been approved.) Dr. Bailey seconded Father Yancey's motion for *approval* and it *was so voted.*

The *Report of the Secretary and the Admission to Membership Committee* was given. (Copy attached) (Summary of report: Presimembership in the Academy is 538. Of these, 438 are individual members, 43 are collegiate, 42 are complimentary, and 15 are in the category of honorary and life memberships.) Dr. Wilkes moved, Dr. Irons seconded, and the members voted *approval of the report.*

There was no formal *Report of the Membership Committee.* (Summary of report: Dr. Barker urged that all members be more active in the recruiting of members.) Dr. Irons moved and Mr.

Goetz seconded approval of the report. A vote of the members gave *approval of the report.*

Dr. Tower gave the *Report of the Special Committee on National Science Foundation Grants.* (Summary of report: An application has been presented to NSF for $15,927 to permit an experimental program in the Birmingham area, a program whereby speakers with special demonstration kits would present lectures at the high school level.) Dr. Carr moved the approval of the report. Upon a second by Dr. Barker, the members *voted their approval.*

There was no *Report of the Finance Committee.*

The *Report of the Treasurer* was given by Dr. Barrett. (Copy attached) (Summary of report: There is a balance of $2,485.00 in the treasury; $2,164.00 in the General Fund and $220.00 in the Research Fund.) Dr. Tower moved and Dr. Wilkes seconded the *approval of the report,* and it *was so voted.*

Dr. Barrett distributed a proposed budget and explained the various categories to the members of the Executive Committee. (Amended copy attached). Mr. Goetz moved and Dr. Carr seconded that the budget be adopted. In the following discussion, President McCullough said that this was the first time that a budget for the Academy had been proposed, and that it was wise to have such a budget. The Alabama Junior Academy expense in the budget is new; the President's expense is a very necessary item in order to carry out the duties of that office properly. Several members expressed their wholehearted approval of having a formal budget. The question of the expenses of the office of Permanent Counselor to the AJAS was brought up.

> *AMENDMENT*: By Dr. Tower, seconded by Dr. Barker.
> The proposed budget be amended to place $80.00 for the use of the Permanent Counselor of AJAS. This amount shall be removed from the item marked contingencies, leaving $100.00 for contingencies. *Amendment approved.*

Upon a call for question, the *amended budget was adopted unanimously*

The *Report of the Editor of the Journal* was given by Dr. Bailey. (Copy attached) (Summary of report: The transition from an annual to a quarterly publication has been a success. There are still minor problems to be met. Several full-length papers will be published in Volume 30. The Editor plans to discuss several questions concerning the Journal with the Editorial Board at this annual meeting in the interest of improving the Journal.) Dr. Barker

moved, Mr. Boozer seconded, and the members voted that the *report be approved.*

There was no *Report of the Editorial Board.*

There was no formal *Report of the Science Education Committee.* Dr. Wilks, chairman of this committee, stated that the formal report would be given at the symposium Thursday, March 13, 1959. (Summary of report: A state-wide conference has been proposed on the evaluation of science teaching, certification of teachers, and teacher training.) Following the motion of Dr. Carr, the second of Mr. Black for approval, the *report was approved* unanimously.

The formal *Report of the Long-Range Planning Committee,* Dr. Barker stated, would be given at the Thursday morning symposium. (Summary of the informal report: Dr. Barker commended the members of the committee for the work they had done. The committee made an examination of the Academy in internal areas and external areas. Internally: There is a need for (1) an examination of the relation between the AAS, the AJAS, and the Regional Science Fair programs; (2) developing a more intensive membership recruiting program and maintaining the interest of present members; (3) programming of meetings to maintain attendance throughout the entire meeting. The invited speaker for the Saturday session is an experiment along this line. Externally: Two positive actions of the Academy have already been mentioned in earlier reports: the proposal to NSF and the proposal by the Science Education Committee for a conference to examine education requirements for knowledge of subject matter as well as knowledge of teaching methods. Further areas in the external field are improvement of relations with the State Department of Education by a diplomatic offering of the services of the Academy and the public education of lay people through TV, radio, and newspaper publicity. Specific recommendations in regard to item (1) will be in the reports of the Counselor to the AJAS and the Coordinator of Science Fairs.) Father Twellmeyer moved and Dr. Hisey seconded the approval of the report. *Approval was so voted.*

President McCullough ruled that a 15-minute break was in order.

President McCullough called the meeting to order and asked for the *Report of the Counselor of the Alabama Junior Academy of Science.* This report was given by Mr. Boozer.

[*Journal Editor's Note: The Report is included in full in the minutes. However, it is omitted here since the "Report of Counselor of the Ala-*

bama Junior Academy of Science, 1958-59," is published separately in this issue, beginning on page 66.]

> *MOTION:* By Dr. Carr, seconded by Father Twellmeyer. The Proposed Constitutional Amendments be approved. *Motion Carried.*

Dr. Carr moved and Dr. Barrett seconded the motion that the Report of the Counselor of the Junior Academy be approved. *Approval was voted unanimously.*

The *Report of the Coordinator of Science Fairs* was given by Father Twellmeyer. (Copy attached) (Summary of report: Four Regional Fairs will be held in 1959, with two finalists from each fair going to the National Science Fair. Two science fairs have already been held, and a request for a new Regional Science Fair covering the area served by Jacksonville State College has been received by the Coordinator from Dr. Houston Cole. The coordinator recommends that the Executive Committee authorize a study of a redistribution of the counties of Alabama into regions for Regional Science Fairs, such a study to be made by the Committee on Regional Science Fairs and the Counselors of the Alabama Junior Academy of Science and to be subject to final approval by the Executive Committee of the Alabama Academy of Science. The coordinator further recommends that a resolution acting on the request of Dr. Cole might also be in order.) Dr. Wilks moved that the report of the Coordinator of Science Fairs be accepted without acceptance of any resolution. Mr. Goetz seconded this motion and *acceptance was so voted.*

President McCullough recognized Dr. James Wilkes, who presented the following resolution:

> Whereas, Dr. Houston Cole, President, Jacksonville State College by letter of February 19, 1959, has requested the establishment of a Regional Science Fair Area under the sponsorship of Jacksonville State College, and
>
> Whereas, the Counselors of the Alabama Academy of Science, and the Committee on Regional Science Fairs of the Alabama Academy of Science have favorably considered this request and do hereby recommend the establishment of said region;
>
> Be it resolved that this Executive Committee does hereby approve the establishment of a Regional Science Fair hereinafter to be referred to as the Northeastern Regional Science Fair, under the sponsorship of Jacksonville State College, which re-

gion is to incorporate the following counties: Calhoun, Cherokee, Clay, Cleburne, DeKalb, Etowah, Randolph, St. Clair, Talladega.

Respectfully submitted,
James C. Wilkes, Jr.
Permanent Counselor, Pro Tem
Alabama Junior Academy of Science

The *resolution* presented to the Executive Committee was *approved as read.*

The *Report of the Cooperator to Science Clubs of America* was given by Dr. Kassner. (Copy attached) (Summary of report: Dr. Kassner gave the number of high schools affiliated with Science Clubs of America(over 300 to 500), the places of NSF institutes for high school teachers, and suggested that the Academy appoint a committee to evaluate standards to be used in the selection of the Academy award winner.) Mr. Boozer moved approval of the report. Upon a second by Dr. Grove, *approval was voted.*

The *Report of the Archivist and Committee on the History of the Academy* was given by Mr. Cantrell. (Summary of report: Mr. Cantrell asked the wishes of the Executive Committee in regard to sending the Journal to reviewing journals. He asked permission for binding of archive materials. He reported that nine chapters of the history of the Academy were completed, the chapter on the early history would be completed within the week, and that Peter Brannon would have the concluding chapter completed within two weeks of this meeting. Various tables, charts, and appendices remain to be completed.)

MOTION: By Dr. Carr, seconded by Dr. Barker.
The archivist shall undertake having the Journal sent to all reviewing journals. *Motion carried.*

MOTION: By Dr. Barker, seconded by Dr. Burton.
The archivist is authorized to bind archive materials.
Motion carried.

Upon Dr. Barker's second of Dr. Tower's motion for *approval of the report, it was so voted.*

President McCullough called for *New Business.* President McCullough stated that the present Article of Incorporation of the Academy required that the Coordinator of Science Fairs be elected annually rather than triennially. He proposed that the Article of Incorporation be changed so that election would be for the three-year term, and that this amendment be presented to the

Academy for a vote at the Annual Business Meeting. The Secretary read the proposed amended Article:

ARTICLE VIII. Section 3.

The tenure of office shall be for one year or until successor shall be elected, except that the Trustees, the Secretary, the Treasurer, the Councilor to the American Association for the Advancement of Science, the Editor, the COORDINATOR OF SCIENCE FAIRS and the three counselors of the Junior Academy, one of whom shall be elected each year to replace one whose term is expiring, shall serve three years and shall be elected triennially.

Dr. Barker moved, Dr. Wilkes seconded that the Executive Committee approve presentation of the above amended article to the Annual Business Meeting for a vote. *The motion was carried.*

The Secretary read the proposed amendments to the By-Laws of the Academy: As a substitution for the present Section:

ARTICLE IV, Section 9. Committee on Junior Academy.

This Committee shall consist of the Counselors of the several regions, the state officers of the Junior Academy of Science, the sponsors of the state officers of the Junior Academy, and the three Counselors elected by the Alabama Academy of Science.

As a new Section:

ARTICLE IV. Section 16. Committee on Regional Science Fairs.

This committee shall consist of the state Coordinator of Science Fairs and the Regional Coordinators of the several regions.

As a modification of the present section:

ARTICLE V. Section 20. Committee on Junior Academy.

The duties of this committee shall be to coordinate the activities of the several regions of the Junior Academy in cooperation with the Coordinator on Regional Science Fairs, to promote the organization of chapters and by all possible means promote the welfare of the chapters, the regions and the entire Junior Academy.

As a new Section:

ARTICLE V. Section 27. Committee on Regional Science Fairs.

The committee on Regional Science Fairs shall coordinate the activities of the Regional Science Fairs in cooperation with the Counselors of the Junior Academy of Science.

Following a motion by Dr. Wilkes and a second by Father Twell-

meyer, the members of the *Executive Committee voted the adoption of the Amendments to the By-Laws.*

President McCullough invited the final motion of the meeting. Placed by many and seconded by the rest, the meeting was adjourned.

Respectfully submitted,
Hoyt M. Kaylor,
Secretary

ALABAMA ACADEMY OF SCIENCE
ANNUAL BUSINESS MEETING

Thach Auditorium, Alabama Polytechnic Institute
Auburn, Alabama, March 14, 1959

President McCullough called the meeting to order at 8:30 a.m.

The minutes of the Howard College Meeting of April 2, 1958, were distributed in mimeographed form. Dr. Carmichael moved the acceptance of the minutes as mimeographed. Dr. Wilkes seconded and the *minutes were approved.*

The Secretary gave a summary of the actions of the Executive Committee Meeting of March 12, 1959, followed by a brief *Report of the Secretary.* Dr. Tower moved, Dr. Wilks seconded, and the members voted *approval of the report.*

The *Treasurer's Report* was given by Dr. Barrett. Upon a motion by Dr. Arnold a second by Mr. Goetz, the members voted and the *report was approved.*

The *Report of the Councilor to AAAS,* given by Father Yancey, *was approved,* following a motion by Dr. Carmichael, and seconded by Dr. Barker, and a vote of the members.

The Report of the Auditing Committee for the Senior Academy was read by the Secretary. (The report: The books have been examined and found to be in good order.) Dr. Wheeler moved the acceptance of the report. Mr. Goetz seconded and the *report was approved.*

Dr. Arnold reported that due to an expected new arrival in the Patton family, Dr. Patton could not bring the books of the Junior Academy to the meeting. The auditing would be done and reported.

Father Yancey read the *Report of the Nominating Committee*:
President: Samuel B. Barker *President-Elect*: James R. Goetz

Vice-Presidents and Section Chairmen		Vice-Chairmen	
I	Robert A. Dietz	I	William Ivey
II	Kenneth M. Gordon	II	Charles E. Feazel
III	Earl L. Hastings	III	David L. DeJarnette
IV	David E. Hampe	IV	Vernon J. Knight
V	R. E. Wheeler	V	L. J. Eisele, S. J.
VI	John Baswell	VI	James Sulzby, Jr.
VII	Lucile Lloyd	VII	Jerome G. Kuderna
VIII	E. C. Paustian	VIII	E. D. Chastain
IX	Thomas E. Hunt	IX	Roger W. Hanson

Secretary: Wilbur B. DeVall.

Permanent Counselor of the Alabama Junior Academy of Science: James C. Wilkes, Jr.

Associate Counselors of the Alabama Junior Academy of Science: Gid E. Nelson, Jr., (two-year term) and Reuben Boozer, (one-year term).

Coordinator of *Science Fairs* (Three year term): Father George Twellmeyer.

Trustees (Terms to expire in 1962): Ralph Draughon and C. M. Farmer.

Chairman of the Board of Trustees: James Sulzby, Jr.

Dr. Carmichael moved and Father Furman seconded that the Secretary be authorized to cast a unanimous vote for the slate. *Motion passed.*

Dr. Carr gave the *Report of the Place-and-date-of-Meeting Committee.* The Academy has received an invitation from Athens College from the former President of that Institution. Dr. Carr has written to the new president and at the time of the meeting has received no reply. Since it is customary that such action of a former administrator be honored, Dr. Carr moved that the Academy accept the invitation subject to any contingencies that might arise. Dr. Capps moved acceptance of the report, Dean Allen seconded and the *report was approved.*

Dr. Tower gave the *Report of the Resolutions Committee.* (Copy attached). Following a motion by Dr. Barker and a second by Mr. Goetz, the *report was approved by standing vote.*

Professor DeVall introduced the area chairmen of the Local Arrangements Committee and their sub-chairmen.

President McCullough expressed his appreciation to the Academy as a whole for cooperation during his term of office.

President McCullough called for New Business.

MOTION: By the Secretary, seconded by Dr. Barrett.

ARTICLE VIII, Section 3, of the Article of Incorporation of the Alabama Academy of Science be amended to read as follows: The tenure of office shall be for one year until successor shall be elected, except that the Trustees, the Secretary, the Treasurer, the Councilor to the American Association for the Advancement of Science, the Editor, the COORDINATOR OF SCIENCE FAIRS and the three counselors of the Junior Academy, one of whom shall be elected each year to replace one whose term is expiring, shall serve three years and shall be elected triennially.

Amendment passed.

President reminded the members of the General Session following the Section meetings at which the invited speaker, Dr. Roger Williams, would be heard.

President McCullough declared the meeting adjourned at 9:05 a.m.

Respectfully submitted,
Hoyt M. Kaylor,
Secretary

ALABAMA ACADEMY OF SCIENCE

STATEMENT OF ACCOUNT

For the Period March 21, 1958, to February 5, 1959

Bank Balance — February 5, 1959		$2,485.06
General Fund:		
Balance as of March 21, 1958	$1,830.49	
Receipts	1,011.39	
	2,841.88	
Disbursements	677.56	
		2,164.32
Research Fund:		
Balance as of March 21, 1958	493.24	
Receipts	177.50	
	670.74	
Disbursements	350.00	
		320.74
		2,485.06

Checked against receipts and disbursements,
February 6, 1959.

William J. Barrett, Treasurer
Alabama Academy of Science

Auditing Committee:
Charles E. Feazel
Wiley S. Rogers

RESOLUTIONS COMMITTEE REPORT

Your resolutions committee submits herewith the following resolutions:

1. Whereas the Alabama Academy of Science is successfully completing its 36th annual meeting, now therefore be it resolved
   a. That the Academy expresses its appreciation to Alabama Polytechnic Institute and to its president, Ralph B. Draughon, for their hospitality;
   b. That special appreciation is expressed for the work of Wilbur B. DeVall and Alwyn J. Atkins and their associates, to the news media and housing agencies of Alabama Polytechnic Institute, and to the Auburn Chamber of Commerce, who have provided so effectively for local arrangements for both the Senior and Junior Academies;
   c. That the gratitude of the Academy is expressed to the Birmingham Division of E. H. Sargent & Company for their hospitality in providing the annual dinner.
2. Whereas during the past year death has deprived the Academy of the valued services of its members, now therefore be it resolved that the Academy express its sympathy to the families of Miss Catherine Shaver, Dr. George W. Hess, and Dr. E. C. Unnewehr and its appreciation of the loyal and valuable services which they gave to the Academy.

John A. Fincher
Walter K. Herndon
James A. Tower, Chairman

ALABAMA ACADEMY AWARD—1959

The Alabama Academy Award, the highest honor given a high school science teacher in Alabama, was conferred upon Sister Mary Robert at the twenty-fifth annual convention of the Alabama Junior Academy of Science.

Approximately two hundred and fifty high school students and their sponsors representing thirty-seven science clubs were present at the Friday evening banquet held in Auburn, Alabama, to see Sister Mary Robert receive the top award from Dr. James L. Kassner, former permanent counsellor to the Junior Academy for many years.

The Academy Award consists of a citation and a yellow gold pin and is given each year by the Alabama Academy of Science to a science teacher for meritorious teaching of science. The purpose of the award is to recognize those teachers who go beyond the classroom to stimulate scientific endeavor among their students.

Sister Mary Robert attended the Convent of Mercy High School, and represented her science club as its official delegate to the ninth annual convention of the Junior Academy in 1941. She received the MA degree from the Novitiate of the Sisters of Mercy Order in Baltimore, in 1948, and returned to Mercy High School in Mobile to teach science.

The Phi Gamma Chi Science Club at the Convent of Mercy was a charter member of the Alabama Junior Academy of Science. In 1949 the name of the club was changed to Phi Beta Chi. Students from the club have held eight offices in the Junior Academy—secretary seven times, and one president. The club has won five Academy Awards and four AAA awards.

What a science club does depend largely on the enthusiasm as well as the ability of the sponsor to direct projects, and to see that her students perform the duties of their elective offices. A successful sponsor learns the thrill of directing youth willing to work for the joy of working.

REPORT OF THE COUNCILOR OF THE AAAS, 1959

I attended the meetings of the Council on December 27 and 30. The main business transacted was as follows:

1. Election of President-elect: Chauncey D. Leake.

2. International Scientific Programs: As a result of the success of the International Geophysical Year the Council urged the AAAS and its affiliated societies to "participate fully in appropriate international programs, for example, in such areas as health sciences, outer space exploration, population problems, and social consequences of science."

3. Committee on the Social Aspects of Science: A report of the meeting held by this committee on May 30-June 1 was presented. Its recommendatons for (a) a five-member Committee on Cooperation Among Scientists; (b) a five-member Committee on Public Understanding of Science; and (c) a seven-member Committee on Promotion of Human Welfare, were approved.

4. A resolution presented by our Dr. Ward Pigman, calling for the appointment of a Committee on Council Activities and Organi-

zation to make recommendations to the 1959 meeting on the manner in which the Council can best serve science and the AAAS, was passed and Dr. Pigman was elected a member of this committee.

5. The report of the Committee on Metric Usage was referred back to the committee for further study.

6. Seven new affiliates, including the Arizona Academy of Scence, were admitted.

7. A resoluton that the Board of Directors be asked to consider the problems of professional status of scientists was accepted.

8. The AAAS will hold a meeting on "Support of Basic Research in Science" on May 14-16. The proceedings will be published.

THE ACADEMY CONFERENCE

I was unable to attend all of the sessons of the Academy Conference. I did attend a breakfast meeting of the Executive Committee on December 28 and left a prepared report of our Acadmy to be presented at the Business Session.

In the afternoon there were two panel discussions. The first was on The Academy Movement — Past, Present, and Future. The second on The Adult Approach to Junior Academy Problems. The reports on these have not yet been received.

Dr. John G. Arnold, Jr., of Loyola University of the South (New Orleans) was elected President-elect. Dr. A. M. Winchester, of Stetson University, Deland, Fla., is president this year. Dr. E. Ruffin Jones, University of Florida, was elected secretary.

Respectfully submitted
P. H. Yancey, S. J.,
Councilor of AAAS

REPORT OF THE COORDINATOR OF SCIENCE FAIRS FOR ALABAMA ACADEMY OF SCIENCE, 1958-59

A reorganization of the sponsorship of regional science fairs in Alabama by the Academy was effected by action of the Executive Committee at its meeting at Howard College in Birmingham on November 8, 1959.

The Executive Committee, by its resolution, established a standing Committee on Regional Science Fairs with the State Coordinator as chairman and the Regional Coordinator as members. The purpose of this committee is to determine the policies to be followed by the various regional science fairs. The State Coordinator became an

officer of the Academy. Further, at the annual meeting of the Academy at the Alabama Polytechnic Institute the term of office of the State Coordinator was changed from one to three years.

Responsibility for carrying out the purpose of the Alabama Academy in undertaking the sponsorship of regional science fairs is vested in the coordinating institutions of the respective regions at least one of which must be an institution of higher learning. This responsibility is with regard to the organizing, financing and successful operation of the regional fair.

Two methods of discharging this responsibility are outlined. In the first, for regions with only one coordinating institution, the responsibility is vested immediately in the regional coordinator who is nominated by the coordinating institution. In the second method, for regions with two or more coordinating institutions, the responsibility is vested immediately in a science fair committee on which the several institutions are represented. The committee may or may not incorporate. The regional coordinator, in this latter method, has the obligation of organizing and supervising the operation of the region; the science fair committee, however, may retain the obligation of financing the region.

In either case, the regional coordinator must provide for an operating committee or administrative council of the regional fair whose purpose, in view of the reorganization of the Alabama Junior Academy, is to provide the executive committee of the region of the AJAS with the means of operating the annual regional fair. Further, the resolution of the Executive Committee of the AAS requires that a trusteeship be established in each region to receive contributions and to provide for the financing of the regional fair. This may either be a simple trust agreement or be provided for in the framework of an incorporated region. The intent in this is to prevent funds contributed for the financing of the regional science fair being diverted into other uses. It is intended and hoped that each region will apply for and obtain tax exemption to facilitate financing of the regional fair.

The intent of the Alabama Academy of Science in reorganizing its sponsorship of the regional science fairs and the Alabama Junior Academy of Science is to provide for closer cooperation between the two organizations in their single purpose of increasing interest and activity in mathematics and science among senior and junior high school students. To this end, regional divisions of the AJAS and associate chapters for junior high schools have been provided for by amendments to the constitution of the AJAS. The position of Re-

gional Counselor has been established who is to be both the Chairman of the Executive Committee of the Region of the AJAS and the Executive Secretary of the Administration of the regional science fair. The Regional Coordinator and the Regional Counselor are to hold their offices indefinitely dependent on the State Coordinator of the Regional Science Fairs and the nominating authority in the former case and on the Permanent Counselor of the AJAS in the latter.

The Administration of the Regional Science Fair depends for its membership and operation on the Regional Coordinator; the Executive Committee of the AJAS depends for its membership and operation on the Regional Counselor. Since such an organization has developed during the past five years and is in operation in the Mobile Region, it might prove helpful to outline it here.

ADMINISTRATIVE COUNCIL	EXECUTIVE COMMITTEE
Regional Coordinator	
Executive Secretary	Regional Counselor
Corresponding and Recording Secretary	Chairman of Planning
	Chairman of Local Arrangements
Director of Finance	Chairman of Publicity
Director of Judging and Awards	Chairman of Hospitality
Director of Project Advising	Chairman of AJAS Registration
Director of Publicity	Chairman of Project Registration
Director of Public Functions	Chairman of Teachers Work Conference
Director of Physical Facilities	Chairman of Banquet Arrangements
Trust Officer in Charge of Trust Fund	Historian

George O. Twellmeyer. S. J.

REPORT OF COUNSELOR
ALABAMA JUNIOR ACADEMY OF SCIENCE—1958-59

On October 25, 1958, the executive committee of the Alabama Junior Academy of Science met and made plans for the annual convention to be held (March 13 and 14) concurrently with the Senior Academy on the Auburn campus.

During the year, routine procedures were followed and approximately 45 chapters have made plans for the convention which will include meetings, tours, static displays of exhibits, papers for presentation, banquet and party. The officers of the Junior Academy have performed their duties exceedingly well, and have shown an avid interest in the welfare of the Academy.

The counselors of the Alabama Junior Academy of Science on behalf of the Junior Academy express their appreciation to the Senior Academy for:

1. Securing a permanent counselor for the Junior Academy.
2. Presentation of complimentary copies of The Journal of the Alabama Academy of Science to the chapter sponsors of the Alabama Junior Academy of Science.
3. Continued financing of academy awards plus cash bonuses ($25 for the first-place winner in each of the four categories of exhibits; $25 for the best paper; $25 as a cash gift to the academy award winner, plus $50 to be applied to his or her school) as an additive feature for this year only.
4. Inviting the Junior Academy to the Friday afternoon session of Sections I and IX of the Senior Academy.
5. Effecting a joint meeting of the academies to share and enjoy an address by a renowned speaker.
6. General interest.
7. Studies of the long-range planning committee to determine and effect wider participation in and success of the Junior Academy.

In view of probable changes in the operation of the Alabama Junior Academy of Science, the counselors submit the following recommendations:

1. That the permanent counselor be authorized to appoint a committee to study and recommend a more desirable award to the Alabama Junior Academy of Science winners.
2. That a substantial, permanent financial budget of $405.00 be established for the Junior Academy.
3. That the long-range planning committee be authorized to amend or rewrite the constitution of the Alabama Junior Academy of Science to take care of proposed changes accepted by the Senior Academy.
4. That the Senior Academy accept the following proposed con-constitutional amendments of the Alabama Junior Academy of Science:

PROPOSED CONSTITUTIONAL AMENDMENTS
TO THE JUNIOR ACADEMY OF SCIENCE

In view of the suggested changes in the program of the Alabama Junior Academy of Science and the Regional Science Fair activities of the Alabama Academy of Science, it seems advisable to add a new Article "Administrative Divisions" plus revisions and additions to the present Article on "Membership." The new Article "Adminis-

trative Divisions" should follow Article II "Purpose" causing all subsequent Articles to be renumbered one successive digit.

Article III — Administrative Divisions

Section 1 **Relationship of Senior and Junior Academies.** The Alabama Junior Academy of Science is a branch of the Alabama Academy of Science, Inc.—hereinafter known as the Senior Academy. The Junior Academy is subject to the jurisdiction of the Senior Academy.

Section 2 **Counselors.** The Senior Academy shall elect such counselors as it deems fit to counsel, aid, encourage and supervise the activities of the Junior Academy.

Section 3 **Establishment of Regional Divisions.** The Junior Academy of Science, under the direction of and with the concurrence of the Senior Academy, may establish Regional Divisions which shall correspond with Science Fair Regions. Such Regional Divisions shall be fully recognized as auxiliary divisions of the Alabama Junor Academy of Science.

Section 4 **Regional Divisions.** Under the direction of the Junior Academy of Science, each Regional Division, upon ts formation, shall enact Regional By-Laws; however, such Regional By-Laws may not conflict with this constitution.

Article IV — Membership

Section 1.1 **Full Membership.** Full membership of the Junior Academy shall consist of high school students interested in scientific activities and who shall meet such other requirements as established by the by-laws of their respective chapters of the Alabama Junior Academy of Science.

Section 1.2 **Associate Membership.** Associate membership of the Junior Academy shall consist of junior high school students interested in science and who shall meet such other requirements as established by the by-laws of their respective associate chapters of their Regional Division.

Section 2.1 **Chapters.** Each chapter shall consist of the sponsor from the science faculty of a high school together with such interested students in a senior high school who have met the requirements for membership as laid down in the by-laws of that chapter.

Section 2.2 **Associate Chapters.** Associate chapters shall consist of the sponsor from the science faculty of the junior high

school together with such interested students in the junior high school who have met the requirements for membership as laid down in the by-laws of that chapter.

Section 3.1 **Chapter Application.** Science clubs interested in becoming affiliated with the Junior Academy shall submit to the Permanent Counselor an application accompanied by a list of club members and dues for the first year. Any senior high school in Alabama that offers eleventh grade courses and meets the standards of the Alabama Junior Academy of Science is eligible for membership consideration. Applications for membership shall be submitted in time for consideration of acceptance by the Alabama Junior Academy of Science at its next annual meeting.

Section 3.2 **Associate Chapter Application.** Science clubs interested in becoming affiliated with the Regional Junior Academy shall submit to the Regional Counselor for application accompanied by a list of the club members and dues for the first year. Any junior high school in Alabama that offers eighth grade courses and meets the standards of the Regional Division is eligible for membership consideration.

Section 4.1 **Chapter Limitations.** Each high school shall be limited to one chapter, although a chapter may consist of more than one science club in that school.

Section 4.2 **Associate Chapter Limitations.** Each junior high school shall be limited to: (1) One chapter, although a chapter may consist of more than one science club in that school; (2) Participation in the activities of their respective region; (3) Participation in the regional business meeting by having only one voting delegate; (4) Positions on regional committees—they shall not hold elective offices of their region.

Respectfully submitted
Reuben Boozer, AJAS Counselor

REPORT OF COOPERATOR TO SCIENCE CLUBS OF AMERICA, 1958-59

This year over 300 of the approximately 500 white and Negro high schools in Alabama were affiliated with Science Clubs of America. The Speakers Bureau under the leadership of Herman

Cranberry, West Point Manufacturing Company, Shawmut, Alabama, was continued again this year. However, very few science clubs have availed themselves of this service.

During the summer of 1959 in Alabama there will be summer school Institutes for High School Teachers of Science and Mathematics at Alabama College, Alabama Polytechnic Institute, Birmingham-Southern College, Spring Hill College, Tuskegee, Institute, and the University of Alabama. These institutes are financed by the National Science Foundation in cooperation with the respective colleges. Each of the participants in the institute will receive $75.00 a week, plus $15.00 a week for each dependent up to four in number, and a travel allowance.

The Academy should appoint a committee to evaluate standards to be used in the selection of the Academy award winner.

The State Department of Education and a committee appointed by the Academy will cooperate in setting up specifications and recommendations on equipment for high school science courses.

James L. Kassner

REPORT OF THE SCHOLARSHIP COMMITTEE FOR THE GORGAS SCHOLARSHIP FOUNDATION, Inc.

1957-1958

The annual Alabama State Science Talent Search completed its sixth year under the sponsorship of The Gorgas Scholarship Foundation, Inc. The winners from the white high schools were announced at the annual meeting of the Alabama Academy of Science on March 31 and April 1, 1958, at Howard College. The winners from the Negro high schools were announced at Southern Research Institute on June 14, 1958.

Eighty seniors representing twenty white high schools (public and private) in the State of Alabama completed the aptitude examination which was conducted by the Science Clubs of America, and administered by Science Service for the Westinghouse Science Scholarships.

Of these students, twelve were selected as finalists and invited to appear before a board of judges during the annual meeting of the Alabama Academy of Science at Howard College, Birmingham, March 31 and April 1, 1958. Two of the finalists elected not to compete in the Alabama Science Talent Search.

The ten finalists were personally interviewed by the Scholarship Committee on March 31, 1958, at Howard College. Winners were announced at the annual banquet of the Alabama Junior Academy of Science on April 1, 1958, by William M. Murray, Jr., Director, Southern Research Institute, Birmingham.

	NAME	SCHOOL
1st award	J. L. Marshall	Decatur High School
2nd award	M. C. Smith	Woodlawn High School
3rd award	B. P. Tunstall	Tuscaloosa High School
4th award	W .C. Pope, Jr.	Woodlawn High School
1st alternate	C. B. Compton	Decatur High School
2nd alternate	W. A. Smith	C. F. Vigor High School
3rd alternate	J. B. Anders	Tuscaloosa County High
4th alternate	C. F. Hendrix	Fayette County High
5th alternate	Anne Rodgers	Tuscaloosa County High
6th alternate	H. E. Jones	C. F. Vigor High School

Fifty-two seniors representing seven Negro high schools in the State of Alabama completed the aptitude examination which was conducted by the Science Clubs of America, and administered by Science Service for the Washington Science Scholarships.

Of these students, five were selected as finalists and were invited

to the Southern Research Institute for an interview by the Judges at 1:00 P. M., Saturday, June 14, 1958.

The Negro finalists were interviewed by the Scholarship Committee on June 14, 1958, at Southern Research Institute and the winners were announced that afternoon:

	NAME	SCHOOL
1st award	M. D. Lee	Covington County Training
1st alternate	A. McAlpin	Fairfield Industrial H. S.
2nd alternate	Cleo Dees	Camden Academy
3rd alternate	H. G. Shores	Parker High School
4th alternate	J. Rumph	Fairfield Industrial H. S.

JUDGES

Names	Company
Dr. John A. Southern, Chairman	Howard College
Mr. William Brancroft, Jr.	Howard College
Mr. L. S. Hazelgrove	Howard College
Dr. George Irons	Howard College
Dr. John Wintter	Howard College
Mr. Joseph A. James	Alabama By-Products Corporation
Dr. Samuel B. Barker	Alabama Medical Center
Mr. C. T. Brasfield, Jr.	Alabama Power Company
Mr. Royce Murray	Alabama Power Company
Mr. C. K. Donoho	American Cast Iron Pipe Company
Mr. Alex Turner	Avondale Mills
Dr. Harold Wilcox	Birmingham-Southern College
Dr. Fred Griffitts	Birmingham-Southern College
Dr. Frank Soday	Chemstrand Corporation
Mr. Frank W. Atchison, Jr.	The Ingalls Iron Works Company
Mr. P. H. Haskell, Jr.	Pratt Coal Company
Mr. W. C. Horton	Pullman-Standard Car Mfg. Company
Dr. R. E. Burks, Jr.	Southern Research Institute
Dr. E. B. Dismukes	Southern Research Institute
Dr. William S. Wilcox	Southern Research Institute

FINALISTS IN THE ALABAMA STATE SCIENCE TALENT SEARCH, 1958

WHITE CONTESTANTS	COLLEGE ATTENDING	SCHOLARSHIP	MAJOR
James L. Marshall	Davidson College, N. C.	$800 per yr.	Chemistry
Mark C. Smith	Georgia Institute of Technology	Owens-Illinois $746 per yr.	Electrical Engineering
Brian P. Tunstall	Mass. Institute of Technology	National Merit $1350 per yr.	
William C. Pope, Jr.	Alabama Polytechnic Institute	Gorgas Award $300 per yr.	Engineering Physics
Carlton B. Compton	Mass. Institute of Technology	None	Electrical Engineering
W. A. Smith	Tulane University	N. R. O. T. C. $900 per yr.	Physics
J. Burwell Anders	University of Alabama	Gorgas Award $225 per yr.	Engineering
Charles F. Hendrix	University of Alabama	Gorgas Award $150 per yr.	Engineering
Anne Rodgers	Agnes Scott College	None	Pre-Med
Henry E. Jones	Tulane University	Freshman Honor $580 per yr.	
NEGRO CONTESTANTS			
Marvie De Lee	Tuskegee Institute	Gorgas Award $300 per yr.	Chemistry
Aubrey McAlpin	Tuskegee Institute	$400 per yr.	Science
Cleo Dees	Morehouse College Ga.	Tuition $300 per yr.	Chemistry
Helen Glynn Shores	Fisk University	None	Biology
Julia Rumph	Alabama State College	None	Science

——-Emmett B. Carmichael

ALABAMA JUNIOR ACADEMY

OF SCIENCE

Proceedings

of

Twenty-Fifth Annual Meeting

Alabama Polytechnic Institute

Auburn, Alabama

March 13-14, 1959

Alabama Junior Academy of Science

1959-60 DIRECTORY

SCHOOL	SPONSOR
1. A. G. Parrish High School Selma, Alabama	Mrs. Harry Reid
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13. Ensley High School 2301 Avenue J Birmingham 8, Alabama	Miss Kathryn Boehmer

14. Foley High School Foley, Alabama	Mr. Clyde J. McSpadden
15. Fairhope High School Fairhope, Alabama	Mrs. Rebecca B. Jones
16. Fort Payne High School Fort Payne, Alabama	Mr. B. V. Noles
17. Hewitt-Trussville High School North Mall Trussville, Alabama	Mr. Fred Whittaker
18. Hueytown High School 131 Dabbs Avenue Hueytown, Alabama	Miss Edith Geisler
19. Huntsville High School Huntsville, Alabama,	
20. John Carrol High School 2316 Highland Avenue Birmingham, Alabama	Sister Mary Leo, O. S. B.
21. John Herbert Phillips High School 2316 7th Avenue North Birmingham, Alabama	Mr. Michael Baranelli
22. Julius T. Wright School for Girls 1315 Dauphin Street Mobile, Alabama	Mr. J. J. Reardon
23. Marion Military Institute Marion, Alabama	Mr. R. L. Trawick
24. McAdory High School Route 1 McCalla, Alabama	Mrs. Ruby Hodge
25. McGill Institute 1501 Old Shell Road Mobile, Alabama	Brother Cyr, S. C.
26. Mercy High School 6 North Bayou Street Mobile, Alabama	Sister Mary Robert, R.S.M.
27. Minor High School 1109 50th Street West Birmingham, Alabama	Mrs. Margaret McClusky Miss Claudia Smith

28. Montevallo High School Montevallo, Alabama	Miss Ethel Harris
29. Hayneville High School P. O. Box 1064 Hayneville, Alabama	Mrs. Caswell McCurdy
30. Murphy High School Carlen Street Mobile, Alabama	Miss Mary Bragg
31. Opp High School Steward Avenue Opp, Alabama	Mr. Lloyd M. Cook
32. Red Bay High School P. O. Box 8 Red Bay, Alabama	Mrs. Gordon Gober
33. Robert E. Lee High School Ann Street Montgomery, Alabama	Mr. Jesse L. Price
34. Russellville High School Russellville, Alabama	Mrs. Edgar Underwood
35. Sacred Heart High School Cullman, Alabama	
36. Satsuma High School Satsuma, Alabama	
37. Semmes High School Semmes, Alabama	Miss Mary E. Ward Mrs. Kate M. Neel
38. Shades Valley High School Shades Valley, Alabama	Mrs. Pauline K. Long
39. Sidney Lanier High School South Court Street Montgomery, Alabama	Mr. Glass Mr. Faulkner
40. S. R. Butler High School Huntsville, Alabama	Mrs. Ibbie K. Bradford
41. St. Bernard Prep. School St. Bernard, Alabama	Rev. Gerald Bray
42. Talladega High School 414 Oak Street Talladega, Alabama	Mr. James H. Ingle

43. Tallassee High School Tallassee, Alabama	Mr. John L. Baxter
44. Theodore High School Theodore, Alabama	
45. Thorsby High School Thorsby, Alabama	Mr. James H. Kincaid
46. Troy High School Elm Street Troy, Alabama	Gladys W. Cowart
47. Tuscaloosa County High School 2200 24th Street Northport, Alabama	Mrs. Geraldine Hargrave
48. Tuscaloosa High School 905 15th Street Tuscaloosa, Alabama	Mr. L. W. Lindsay
49. West End High School 1840 Pearson Avenue Birmingham 11, Alabama	Miss Mary E. Hafling
50. Woodlawn High School 5620 First Avenue North Birmingham 6, Alabama	Mrs. Estelle Jackson
51. Chilton County High School Clanton, Alabama	V. L. Bulger Fay Wells

Minutes of the Alabama Junior Academy of Science

TWENTY-FIFTH ANNUAL MEETING

Alabama Polytechnic Institute, Auburn, Alabama

MARCH 13-14, 1959

The caucus of officers, official delegates, and nominees for office was called to order by the President, Theresa Hagendorfer, at 10:30 a. m. in Langdon Hall. Mr. Gid E. Nelson, Associate Counselor, and Mr. C. J. McSpadden, Foley High School sponsor, were present. Those schools present at this convention were:

School and Sponsor	*Official Delegate*
A. G. Parrish	Lamar Frazer
Athens, Mrs. Hazel Ruff	Sharon Chisholm
Baldwin County, Miss Lillian Leonard	Charles Strong
Bishop Toolen, Sister Mary Lois	Ruthie McConnell
C. F. Vigor, Mr. Alvin Simmons	Dickie Bass
Choctaw County, Mrs. Wyman Gilmore	Glenda Darnell
Cullman, Miss Opal Cooper	Virginia Stewart
Dora, Miss Dorothy Ellison	Johnny Key
Ensley, Miss Kathryn Boehmer	Melvin McIlwain
Foley, Mr. C. J. McSpadden	Knut Mueller
Hayneville	Barbara Williamson
Hueytown, Miss Edith Geisler	Linda Faye Hicks
John Carroll, Sister Mary Leo, O.S.B.	James Rhodes
Julius T. Wright, Mrs. J. J. Reardon	Annise Waterman
Marion Institute, Mr. R. L. Trawick	K. F. Weikert
McGill Institute, Brother Cyr, S. C.	Steve Zieman
Mercy, Sister Mary Robert, RSM.	Ann Doody
Minor, Mrs. Margaret McCluskey	Royce Threadgill
Montevallo, Miss Ethel Harris	Terry Phillips
Murphy, Miss Mary Bragg	Iris Overstreet
Opp, Mr. Lloyd M. Cook	John Morgan
St. Bernard Prep., Rev. Gerald Bray	Joseph Wagner
Semmes, Mrs. Mary E. Ward	Darrel Napier
Shades Valley	Eddie Forbes
Talladega, Mr. James Ingle	John Tibbits
Tuscaloosa, Mr. L. W. Lindsay	John Scott
West End, Miss Mary E. Hafling	Margie Jackson
Woodlawn, Mrs. Estelle Jackson	Tom McCain
Fairhope High, Mrs. Rebecca Jones	Ed Lyren

Huntsville	Leon Valisok
Phillips High, Mr. Michael Baranelli	James Minor
Sidney Lanier, Mr. Glass	Bob Tate
Decatur, Mr. John H. Teague	Wilson Morgan
*Albertsville	Danny Davis

**Re-instated at Convention—*

Also reinstated were Curry High School, Chilton County High, Satsuma, and Thorsby High Schools.

Roll was called at the caucus by the Secretary. Schools not present were: A. G. Parrish, Cullman, Marion Institute, St. Bernard, Albertsville and Hayneville. Of those present Fairhope was the only school with unpaid dues but they were paid at the meeting.

Larry Yarbarough, Vice-President, gave all the delegates name cards to be worn during the Convention. Then the President read the By-Laws of the Constitution concerning the nomination of officers and rules for campaign posters. The candidates were then asked to leave the room.

Each of the nominees was brought in individually to speak in his own behalf after Theresa gave a brief run-down of his qualifications.

Steve Zieman, McGill, made a motion that the candidates for secretary and treasurer be accepted to the slate as they were unopposed. Charles Strong, Bay Minette, seconded it. The motion carried.

The slate for president and vice-president was then voted upon, leaving each position with two nominees.

The votes were counted by Vice-President Larry Yarbarough and Secretary Joyce Donivan.

Theresa then announced the following slate of officers after the votes of the official delegates were counted:

President: James Jones, Murphy High School; Eleanor Long, Woodlawn High School.

Vice-president: Eric Revere, McGill Institute; Eddie Forbes, Shades Valley High School.

Secretary: Glenda Brown, Minor High School.

Treasurer: Paul Shultz, Foley High School.

As the President announced the slate, the Vice-President presented the candidates with their ribbons except the secretary and treasurer. The meeting was adjourned until the 1:00 p. m. business meeting.

The 1:00 P. M. business meeting was called to order by the President, Theresa Hagendorfer, in Langdon Hall.

The secretary called roll and all schools were present except: Cullman, Dora, Hayneville, Hueytown, Marion, St. Bernard, West End, Woodlawn, and Phillips High.

The President then called on Larry Yarbarough, Vice-President, who had been named chairman of the resolutions committee at the executive meeting in October. Larry then read the names on his committee. They were: Larry Yarbarough, C. F. Vigor High School; Ann Doody, Mercy High School, Knut Mueller, Foley High School, John Scott, Tuscaloosa High School; John Morgan, Opp High School; Sponsor: Brother Cyr, S. C., McGill Institute.

Ribbons were then presented to the secretary and treasurer who were absent when they were presented at the end of the caucus.

The official slate of officers was announced and the candidates were presented.

The President then brought up the proposed changes of the Junior Academy of Science.

Theresa read the proposals which she said had been accepted without any changes by the Senior Academy.

The proposals read as follows:

[*Journal Editor's Note: See "Proposed Constitutional Amendments to the Junior Academy of Science" published as part of the Report of Counselor in this issue, beginning on page 68.*]

A motion was made and seconded to accept the proposals as read.

The floor was then opened for discussion. Mr. Reuben D. Boozer and Father George Twellmeyer, S. J., explained the proposals and answered questions concerning them.

The proposals were then voted upon and accepted.

The President then gave a brief run-down of the agenda for the rest of the day. A choice of field trips to the Botany and Zoology Labs, the School of Engineering, or a T. V. studio was briefly explained by Dr. Atkins, Local Counselor. Dr. Wilkes invited the group to attend the Senior Academy meeting following this one and hear a lecture by Dr. Frazer.

Larry Yarbrough then asked the resolutions committee to meet him at 5:00 P. M. in room 105 in Biggin Hall.

As there was no further business the meeting was adjourned until Saturday morning at the General Assembly.

The Annual Banquet was held in the Cafeteria of the Union Building at 7:00 p.m. Theresa Hagendorfer, President, gave the Presidential Address, following the welcoming address of Dean Fred Pumphrey. The eight finalists were announced in judging of the

scientific papers. The winning exhibits were also announced and the ribbons were presented. The Gorgas Scholarship Winners were announced also.

Following the Banquet, the group retired to the Ballroom of the Union Building for entertainment by Mr. Reeder of Jacksonville College and a combo from Auburn college. Dancing completed the evening.

The President, Theresa Hagendorfer, announced the reading of the papers by the eight finalists at 8:15 a.m. Saturday in Langdon Hall.

The finalists were as follows:

1. Leslie Charbonnet, Bishop Toolen, "From Out of This World."
2. Wayne James, Hueytown, "Plasma Jet."
3. James A. Stanton, Marion Institute, "The Birth and the Death of Our Solar System."
4. Lady Andridge, Murphy, "Differences in Personalities of the Five Main Types of Cerebral Palsy."
5. Margie Jackson, West End, "Blue Skies and Red Sunsets."
6. Eleanor Long, Woodlawn, "Effects of Radioactivity and Hormones on Breeding."
7. Lamar Frazer, A. G. Parrish, "Measuring the Velocity of a Bullet."
8. Linda Myers, Ensley, "Endocrine Glands."

The President then called a 10-minute break.

The General Assembly was called to order by the President, Theresa Hagendorfer, at 9:10 a.m. in Langdon Hall. Roll call was taken by the secretary. All schools were present except: Dora, Huntsville, Phillips, and Decatur.

Nominees for office were again presented.

The meeting was handed over to the nominees and their speakers who campaigned a little further.

Steve Zieman made a motion to accept the secretary and treasurer to the respective nominations as they were unopposed. Dickie Bass seconded it. It was unanimously accepted.

Votes were then cast by the official delegates for the President and Vice-President.

While Larry Yarbrough, Vice-President, counted the votes, Theresa announced that several schools wished to be reinstated. They were: Chilton County High School and Curry High School. The President asked for a show of hands in favor of accepting each of

the schools back into the Junior Academy. They were unanimously voted in.

Albertsville asked from the floor to be reinstated and it was unanimously approved by the delegates.

Eric Revere, Treasurer, then made the annual treasurer's report. It states: As treasurer of the Alabama Junior Academy of Science for 1958-59, I beg leave to submit its annual report. 46 schools are charter members of the A.J.A.S. for 1958-59. This year more schools have paid their dues than in any year since the A.J.A.S. was founded.

Dues Collected for 1958-59	$92.00
Membership Cards Sold (338)	$16.90
Total Cash Receipts	$108.90
Expenditures: Stamps, Receipt Book, etc.	$27.65
Total Cash on hand for March 1959	$81.25

Larry Yarbarough then gave resolutions drawn up by the resolutions committee. It reads: "Be it resolved that the Alabama Junior Academy of Science go on record as extending thanks to the following:

Dr. Fred H. Pumphrey, Dean of the School of Engineering; Dr. A. J. Atkins, especially, who as Counselor of Local Arrangements with the help of other members of the Auburn faculty has made our visit most enjoyable; the Auburn High School Science Club whose members assisted in the smooth operation of this Convention; the members of the Senior Academy for their help and inspiration, and particularly Dr. Gid E. Nelson, Chairman of Judging, Alabama College, Montevallo, and his corps of judges and Dr. Gibbes Patton, Associate Counselor, University of Alabama

In a marked manner we render our gratitude to the following persons for their time and efforts displayed in our behalf: Rev. George O. Twellmeyer, S. J., State Coordinator of Science Fairs, Dr. James L. Kassner, State Coordinator for Science Clubs of America, Dr. James C. Wilkes, Permanent Counselor, and Dr. Emmett B. Carmichael, Supervisor of the Gorgas Scholarships.

We extend thanks to Mr. Reeder who furnished entertainment and music at our much enjoyed party.

A special tribute of gratitude we extend to Mr. Reuben B. Boozer, Chairman of the Counselors for the Alabama Junior Academy of Science, who with unstinted generosity has served this organization during the Fall Executive Meeting, during this

Convention, and during the entire year; to our President, Miss Theresa Hagendorfer, her capable officers and their Sponsors, who carried this Convention along rapidly and successfully; to the students of Auburn college who furnished their living quarters; and finally to the Cafeteria management for capable service and excellent meals, and for the continuation of this same service this noon."

Mrs. Lloyd suggested that a copy of the resolutions be sent to each person and staff mentioned in the report.

A five-minute break was then called by the President.

The meeting was re-called to order by the President, in Langdon Hall. Roll was called by the Secretary and all schools were present except Choctaw County, Dora, Huntsville, Phillips, and Decatur.

Albertville named its delegate, Danny Davis, but was not allowed to vote. Two more schools were presented for reinstatement. The President named them: Satsuma High School and Thorsby High School. She then asked for a show of hands that each be reinstated. Both were unanimously accepted and were reinstated.

Several announcements were made by individuals concerning publicity, dormitory keys, lost articles, and the chartered buses.

The President then introduced Dr. James Kassner, who would present the Outstanding Science Teacher Award.

Dr. Kassner thanked the AJAS for its work and cooperation in helping to make the convention a success and also thanked it for the get-well card sent to him by the AJAS after last year's convention at Howard College in Birmingham. He then encouraged the chapters to keep a record of their club's history and to see that the permanent counselor has one.

Dr. Kassner then gave the history and significance of the Academy Award but as the teacher to whom it was to be given was not yet present, the meeting was turned over to Dr. H. McCulla, who made the awards for the winners of the exhibits as announced at the Banquet the night before.

Cups for all schools having winners in each group were not presented as Dr. G. Patton had them in Tuscaloosa and plans for his attending the convention had been necessarily changed at the last moment. So Dr. McCulla said the cups and the money checks would be forwarded to the schools together with the certificates for all the winners, which were as follows:

CHEMISTRY

First Place:	(10" cup)	Paul Schultz, Foley High School, C. J. McSpadden, "Electrochemical Effect of pH on Corrosion."
Second Place:	(8" cup)	Mary Bujarski, Mercy High School, Sister Mary Robert, RSM, "See Vitamin C"
Third Place:	(Certificate)	Wayne White, Hueytown, Edith Geisler, "Experiments in Amateur Rocketry"

PHYSICS

First Place	(10" cup)	James Jones, Murphy High "Tesla Coil"
Second Place:	(8" cup)	William Agee, Parrish High School, Mrs. Harry Reid, "Van der Graff Generator"
Third Place:	(Certificate)	Peggy Paisley, Foley High, C. J. McSpadden, "Centrifugal Force Demonstrated"

BIOLOGY

First Place	(10" cup)	Jack Lilley, McGill Institute, Brother Cyr, S.C., "Survival in Outer Space"
Second Place:	(8" cup)	Mary Ella Steiner, Bishop Toolen High, Sister Mary Lois, "Exterminator of Man"
Third Place:	(Certificate)	Madeline Winters, John Carroll High, Orville Rush, "Demonstrations on Experiments on Cancer Research"

SCIENCE IN INDUSTRY

First Place	(10" cup)	Michael Carpenter, Woodlawn High School, W. B. Reynolds, "Radar"
Second Place:	(8" cup)	Carl F. Wagert, Marion Institute, Ramsay Trawick, "Solid Fuels"

The papers which took honors were announced in reverse placement order:

Honorable Mention: Eleanor Long, Woodlawn High.
Second Place: Margie Jackson, West End High
First Place: Lady Andridge, Murphy High

The AAAS Awards were presented to:

Girl: Eleanor Long, Woodlawn High School, Birmingham, Mrs. Estelle Jackson.

Boy: Eric Revere, McGill Institute, Mobile; Brother Cyr, S.C.

Certificates were presented to the retiring officers for their work.

The program at 11:00 a.m. in Langdon Hall was announced and it was asked that as many as possible try to attend.

Dr. Kassner then presented the Academy Award to Sister Mary Robert, RSM, Mercy High School, Mobile. He presented her with an inscribed pin with the AJAS symbol and two checks, one for herself and one for the club. Dr. Patton also had the Certificate Award and the gold key but it is to be forwarded to Sister Mary Robert, RSM.

Mr. Boozer announced that the AJAS charters would be sent to the respective schools.

Theresa Hagendorfer then expressed her thanks for all participants in the convention and the help given by all.

The final business of the meeting was the announcement of the new officers for 1959-60. The President reversed the order and created much suspense.

The officers named are the following:

President, James Jones, Murphy High School, Mobile.

Vice-president: Eric Revere, McGill Institute; Brother Cyr, S.C., sponsor.

Secretary: Glenda Brown, Minor High School; Mrs. Margaret McCluskey, sponsor.

Treasurer: Paul Schultz, Foley High School; C. J. McSpadden, sponsor.

James Jones officially closed the twenty-fifth annual meeting of the AJAS.

* * * *

Following is the list of exhibits entered in the twenty-fifth annual convention of the AJAS, March 12-14, 1958. (Title, entrant's name, school and sponsor listed in that order.)

BIOLOGY

1. Study in Avitaminosis .... Rosemary Zieman, Convent of Mercy, Sister Mary Robert, RSM
2. Hereditary Factors and Dental Decay .... Cissie Orr, Montevallo, Mrs. Ethel Harris
3. Reptiles .... Eddie Dodd, Dora, Mrs. Dorothy S. Ellison
4. The Value of Proteins in the Diet .... Richard Harmon, Choctaw County, Mrs. Vivian Gilmore

5. Use of Radioactive Isotopes .... Ronnie Guy, A. G. Parrish, Mrs. Harry Reid
6. Comparative Study of the Circulatory System .... Bucky Jackson, St. Bernard, Rev. David Bowes, OSB
7. Molding Flowers in Castalite .... Bettye Lynne Beasley, Red Bay, Mrs. Gordon Gober
8. Hemolysis of Blood .... Bob Tate, Sidney Lanier, Mr. Glass
9. Hydroponics .... James H. Honkala, Decatur, Mr. J. Teague
10. Leaf Pigments .... Paul Miller, Choctaw County, Mrs. Vivian Gilmore
11. Perfusion .... Joseph Lewis, Jr., Phillips, Mr. Michael Baronelli
12. Medical Herbs .... G. Scott Johnson, Decatur, Mr. John H. Teague
13. Exterminator of Man .... Mary Ella Steiner, Bishop Toolen, Sister Mary Lois
14. An Experimental Gas Exchange System ... Jack Lilley, McGill, Brother Cyr, S.C.
15. Demonstration of Cancer Research .... Madeline Jean Wilters, John Carroll, Mr. Orville Rush

PHYSICS

1. Experiments in Amateur Rocketry .... Wayne Satter White, Hueytown, Miss Edith Geisler
2. The 1625 Transmitter .... Loyd Rafalsky, John Carroll, Mr. Rush
3. Man's Best Friend .... Rode Jean James, Cullman, Miss Cooper
4. Oscilloscope .... Bill Whitlow, Ensley, Mrs. McClong
5. Amateur Optics .... Geoffrey Morgan, Shades Valley, Mrs. P. K. Long
6. Atmosphere to Outer Space .... Robert Hodges & Geoffrey Morgan, Shades Valley, Mrs. R. K. Long
7. Multiple Control w/ Two Cond. ... Bill Cakole, Sidney Lanier, Mr. Glass

8. The Quality of Sound .... Mr. Pat Flood, Tuscaloosa, Mr. L. W. Lindsey
9. Electronic Organ .... Marvin Ervin Dailey, Chilton County, Mrs. C. D. Wells
10. A Study of Regular Polyhedrons .... Peggy Flanagan, Athens, Mr. J. D. Clanton
11. Directional Light .... John Nicely, Decatur, Mr. J. H. Teague
12. Using Light in Space Mathematics........ Mary Evelyn Copeland, Semmes, Mrs. Neil
13. Andro Amplification .... John Morgan, Opp, Mr. L. M. Crook
14. An X-ray Outfit .... Thomas Maxwell and Brian Riel, St. Bernard, Father Charles Reiner, OSB
15. Centrifugal Force Demonstrated .... Peggy Sue Paisley, Foley, Mr. C. J. McSpadden
16. Van der Graaff Generator .... Wm. M. Agee, Parrish, Mr. Harry Reid
17. Tesla Ossacilator Transformer .... James Jones, Murphy, Mr. W. W. Fulcher

SCIENCE IN INDUSTRY

1. 3000 MCS Radar .... Mike Carpenter, Woodlawn, W. B. Reynolds
2. Solid Fuels .... Karl Frederick Weikert, Marion, Ramsay L. Trawick

CHEMISTRY

1. Estimation of Vitamin C in Fruit and Vegetable Juices .... Milton Brown, Hueytown, Miss Edith Geisler
2. Electrochemical Effect of pH on Corrosion .... Paul Schultz, Jr., Foley, Mr. C. J. McSpadden
3. See Vitamin C .... Mary Bujarski, Mercy, Sister Mary Robert, RSM

Respectfully submitted,

Joyce Donivan

Secretary of the AJAS

INSTRUCTIONS FOR CONTRIBUTORS

Editorial Policy:

Papers and abstracts of papers to be published in the Alabama Academy of Science Journal may be submitted by both Academy and non-Academy members at any time during the year. Priority, however, will be given to material submitted by members of the Alabama Academy of Science.

Full-length papers which are submitted for possible publication will be judged by a review board on the basis of original data presented and upon the interpretation or review made of the materials presented within a limit of 15 printed pages. An article exceeding this limit will be charged at the rate of $10.00 per additional page. Papers must be submitted solely to the Alabama Academy of Science Journal and must not be reprinted in another publication without the consent of the editor.

Manuscripts:

The manuscript should be typed double spaced allowing good margins. Captions and legends for figures should be typed on sheets separate from the text. Footnotes are not desirable and should be avoided whenever possible. Illustrations should not exceed 20 per cent of the text; the authors of more copiously illustrated articles may be asked to pay for the excess. The title of the paper should be as short as is consistent with clarity. Primary divisions may be indicated by central headings and subdivisions by italicized captions at the margin. Every paper should normally conclude with a summary of numbered paragraphs.

Abstracts of papers should not exceed 200 words and should not include illustrated materials except where absolutely necessary.

Figures:

All figures and tables should be numbered consecutively with legends included. Illustrations (including tables) should be planned to occupy the entire width of a page (4½ inches), and any portion of the height (7 inches). It is best to combine illustrations into the smallest possible number of groups. Original photographs should be submitted in the form of clear black and white prints on glossy paper. Care should be taken to see that they cannot be bent or folded in handling, and paper clips should not be used.

References:

References to literature should be cited by the author's name or by the literature cited reference number. The bibliography should be arranged alphabetically by author under the heading Literature Cited. Complete reference is necessary and the arrangement should normally be as follows: Harper, R. M. Some Menaces ot the Study of Geology. Jour. of Ala. Academy of Science. 27:15-20. 1955.

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Galley proofs will be sent to the author, and the corrected proof and reprint order should be returned to the Editor. Page proofs will be sent only when necessary. Cost of reprints will be indicated at the time proofs are mailed. All manuscripts should be handed to the various Section Chairmen at the close of the Annual Academy meeting or mailed directly to the Editor of the Journal. All correspondence concerning the publication of papers, etc., within the Journal should be addressed to the Editor. Correspondence relative to securing copies of the Journal, etc., should be addressed to Mr. Clyde H. Cantrell, Director of Libraries, A.P.I., Auburn, Ala.

THE JOURNAL

of the

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The Journal of the Alabama Academy of Science is published four times each year, in July, October, January, and April, and is sent without charge to all members of the Academy.

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Abstracts of Papers Presented at Section Meetings

Full Length Papers

Abstracts of Papers, 36th Annual Meeting
Alabama Academy of Science

SECTION I

BIOLOGICAL SCIENCES

Mosquitoes From Lee County, Alabama

WILLIAM C. BARGREN

Alabama Polytechnic Institute, Auburn, Ala.

Mosquito collections were made in Lee County, Alabama during the period July 1957 — June 1958, to determine the number of species inhabiting the county, and their seasonal distribution. Specimens collected represented twenty-six species, thirteen of which, had not been reported previously from this area.

Published reports on the mosquitoes from Lee County date from 1944, and concern collections made at the Opelika Internment Camp, Alabama, an army facility which was disbanded in 1946. Species of mosquitoes found there during the period 1943-45 were as follows: **Aedes aegypti** (Linnaeus), **Aedes vexans** (Meigen), **Anopheles crucians** Weidemann, **Anopheles punctipennis** (Say), **Anopheles quadrimaculatus** Say, **Culex erraticus** (Dyar & Knab), **Culex nigripalpus** Theobald, **Culex pipiens quinquefasciatus** Say, **Culex restuans** Theobald, **Culex salinarius** Coquillett **Culex territans** Walker, **Culiseta inornata** (Williston), **Psorophora ciliata** (Fabricius), **Psorophora confinnis** (Lynch Arribalzaga), **Psorophora howardii** Coquillett. **Uranotaenia sapphirina** (Osten Sacken).

Species of mosquitoes found in Lee County during the period 1957-58, and not previously reported, were as follows: **Aedes atlanticus** Dyar & Knab, **Aedes canadensis canadensis** (Theobald), **Aedes infirmatus** Dyar & Knab, **Aedes triseriatus** (Say), **Chaoborus albatus** Johnson, **Chaoborus punctipennis** (Say), **Culex peccator** Dyar & Knab, **Culex pilosus** (Dyar & Knab), **Culiseta melanura** (Coquillett, **Orthopodomyia signifera** (Coquillett), **Psorophora cyanescens** (Coquillett), **Psorophora discolor** (Coquillett), **Toxorhynchites rutilus septentrionalis** (Dyar & Knab).

The Southeastern Shrew in Alabama

JULIAN L. DUSI

Alabama Polytechnic Institute, Auburn, Ala.

The Southeastern Shrew, **Sorex longirostris** Bachman, was named in 1837 from the type specimen taken from the Santee

Marshes of South Carolina. Since then it has been taken in the Atlantic Plain from Maryland to Northern Florida, also from the Piedmont of Georgia, the Piedmont and Gulf Coastal Plain of Alabama and a disjunct population in Indiana and Illinois.

In Alabama prior to 1950 only one specimen had been taken. This was collected by A. H. Howell, near Autaugaville, from the stomach of a Barred Owl.

Since then the writer has acquired four additional specimens, three from the vicinity of Auburn, and one taken by James E. Keeler at Clayton. Of these specimens, only one was trapped. Two were found dead and one was taken from the pellets of a barn owl.

From the writer's observations these are rather rare animals. The only index to their populations is provided from the feeding of a pair of barn owls over the period of a year. Barn owls apparently feed over the typical habitat of this shrew. By analysis of the owl pellets contents, it was found that of 190 animals eaten, 136 were **Sigmodon hispidus**; 28, **Cryptotis parva**; 8, **Mus musculus**; 5, **Blarina brevicauda; 3 Pitymys pinetorum; 4, Scalopus aquaticus; 4, Peromyscus polinotus; 1 Peromyscus gossypinus**; and 1, **Sorex longirostris. Sorex longirostris** compared with the other shrews; **Cryptotis** was 28 times as abundant and **Blarina**, 5. This certainly bears out the idea of rarity.

From the observations made by the writer the habitat for **Sorex longirostris** is upland old fields of the Piedmont and Coastal Plain; the same habitat as would be expected for **Cryptotis**.

A Little Blue Heron Nesting Population

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A nesting population of the Little Blue Heron, **Florida caerulea** has been studied by the writer since 1952. The population nested over the lakes locally known as the "Hog Wallow Lakes" located along the highway from Tuskegee to Union Springs, in Macon Co., Alabama, about three miles south of Tuskegee.

Dr. Thomas H. Yancey, then a student at API, arranged a visit to the ponds to observe a flight of ibises during the summer of 1952. Since then the writer has studied the population until it was destroyed by a "sporting club" in the spring of 1958.

Banding the young was the most important phase of the studies made. On June 4, 1953, 25 young were banded and 59 more on

June 12. On May 20, 1955, 221 were banded and 394 more on May 27. In 1956, 266 were banded on May 14 and 57 on June 23. In 1957, 140 were banded on May 16. For these four years a total of 1162 herons were banded from this population. To date, the writer has received return records for 16 of these birds, or approximately 1.4 per cent.

The returns come about when some person catches, kills or finds one of the banded birds and sends the band, or a record of its number to the Fish and Wildlife Service in Washington. The band is forwarded to the Bird Banding Office at the Patuxent Refuge, Laurel, Maryland, where the banding records are kept. The F. W. S. sends a record letter to the finder of the band and the bander.

The Little Blue Herons from the Tuskegee nesting area dispersed in all directions. They went northward to Etowah, Tennessee; Rising Fawn, Georgia; eastward to Auburn, Alabama; Columbus, and Eastman, Georgia; westward to Selma, Alabama; Summit, Harpersville, and Philadelphia, Mississippi; and far southward to San Juan, Puerto Rico, Trinidad, B. W. I., Great Inagua, Pregonere, Venezuela, Bahia Honda, Cuba, and Comayagua, Honduras. The ly 2,050 miles from Tuskegee, Alabama.
furthest point reached was Trinidad, B.W.I., which is approximate-

Of the 16 returns, 11 of the birds were collected the same year that they were banded, two were collected the first year after banding, two were collected the second year after banding, one was collected the third year after banding. Since it is seen that the greatest number of returns were collected in their first year of life, it is interesting to note that the greatest number of returns occurred the year 1955 when a total of 615 was banded.

Because the herons are large birds, they fortunately or unfortunately are more often shot and found when wounded or accidentally killed. Thus more bands are recovered from large birds and this is why this nesting population of herons made for an interesting banding study.

Development of Gummy Stem Blight from Infected Watermelon Seed

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Watermelon seed were inoculated with macerated mycelial cultures of **Mycosphaerella melonis**, the causal fungus of the gummy stem blight (black rot) disease of cucurbits. The first symptoms of

the disease in 1958 field plantings of these seed were observed 2 or 3 days after emergence and consisted of dark-green, watersoaked, discolored areas on one side of the cotyledonary leaves near the hypocotyl. The areas were initially circular to elliptical in shape. Under cloudy, humid conditions, infection spread to the shoot tips followed by wilting, necrosis, and death of the seedlings. With clear, sunny weather, spread of infection appeared to be arrested, and necrosis occurred in the affected area resulting in a tan to dark-brown lesion. During the subsequent growth of the first 7 true leaves, the cotyledonary lesions spread and frequently girdled the leaf bases. Fungal spores were disseminated from lesions to leaves by splashing rain, insects, and mechanically by direct contact. Further spread of secondary infection to crowns, stems and leaf petioles resulted in the initiation of cankers, which later girdled, wilted, and killed individual runners, leaves, or entire plants. A red-brown to brownish-black gummy exudate, from which the disease gets its common name, was associated with the stem cankers. In the later stages, the leaves at the crown became brown or were abscissed. Wilting of runners was usually coincident with the period of rapid fruit enlargement.

Fungicidal Control of Bacterial Spot of Peach in Alabama in 1958

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Bacterial spot, caused by **Xanthomonas pruni**, is the most difficult disease of peach to control in Alabama. Experiments to control this bacterial disease have been conducted in Alabama since 1953. In 1958, 8 combinations of established and experimental fungicides and insecticides were evaluated at the Chilton Area Horticultural Substation near Clanton for control of bacterial spot, brown rot, scab, and insects. These sprays were applied to Elberta peach trees in plots of 5 to 7 trees with each treatment replicated randomly 4 times. Trees were sprayed 7 times at 10-14 day intervals between April 17 and July 11, inclusive. Data were taken from approximately 200 peaches per tree or about 1000 peaches per plot. Data were summarized for per cent of clean fruit and per cent of fruit infected by a specific disease.

All fungicidial combinations gave satisfactory control of brown rot and scab. Plots sprayed with sulfur and captan averaged about

20 per cent fruit showing bacterial spot. Only the combinations of Cyprex-sulfur, and sulfur-zinc-lead arsenate substantially reduced the amount of bacterial spot-infected fruit to 10.6 and 7.9 per cent, respectively. However, the latter combination caused severe defoliation and twig injury, reduced fruit size noticeably, and slowed ripening and maturity by 5-7 days. The experimental results with Cyprex warrant further investigation.

Embryonic and Juvenile Stages of the Japanase Quail

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The embryonic stages of the Japanese quail, **Coturnix coturnix japonica** Temminick and Schlegel, are presented for daily intervals from one day of incubation until hatching. Several stages are presented from hatching until sexual maturity. The two outstanding embryonic features of this bird are the relatively short incubation time of sixteen days as compared with other precocial species and the early sexual maturity at six weeks of age. In addition, the eggs are relatively large compared with the size of the adult. Sexes can be distinguished as early as two weeks of age.

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Some Observations on an Unusual Physiological Display of a Brood of Western Ground Snakes with Notes on Parturition

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This paper will deal with a unique physiological display shown by a female Western Ground Snake, **Haldea valeriae elegans**, and her brood which has heretofore been unrecorded. This display might be similar to the "feigning of death" as so commonly practiced by the hog-nosed snakes of the Genus **Heterodon.**

Notes on the parturition of this snake are included since little information is available on this subspecies.

The Cytology Of An Ascites Tumor

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Sarcoma 180, which is a solid tumor, was established in an inbred strain of albino mice currently carried in the biology laboratories of Alabama College, and was then converted into the ascites

form. This was done by macerating the solid tissues, passing it through a fine-meshed screen and injecting the maserated tissue into the peritoneal cavity. Through repeated transplants of fluids which accumulate in the peritoneal cavity, this tumor has been successfully converted into its ascites form.

The cytology of the ascites form has been studied. Points considered include: the chromosome number, the deviation of the chromosome number from the diploid pattern, the frequency of mitotic figures, along with the frequencies of the various stages of mitosis. A comparison between the solid form of the tumor and the ascites form was made. This paper will attempt to present the findings of the project as indicated above.

The Genetic Relationships of Two Chorus Frogs of the Genus Pseudacris

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The degree of genetic compatibility of the two very closely related, allopatric chorus frogs, **Pseudacris streckeri** and **Pseudacris ornata** has been investigated through crossing experiments. Although there is a high level of normal develpment in the F_1, the hybrids appear to be sterile, with upset of normal sex determination in the **ornata** female — **streckeri** male combination. These unexpected results are evaluated in the light of knowledge of levels of interfertility between other closely related anurans.

Reserpine Inhibition of 3, 3, 5 Triiodothyronine Treated Rats. A Preliminary Note.

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It has been demonstrated and confirmed that daily administration of 3, 3, 5 triiodothyronine will put the adult white rat in a hyperthyroid state. In this investigation, four groups of rats, twenty animals in each group, received respectively saline placebo; serpasil*, 1 mg. per kilo; 3, 3, 5 triiodothyronine, 1 mg. per kilo and last group, 3, 3, 5 triiodothyrone followed by serpasil. The drug administration was for a period of thirty days. Oxygen consumption rates were deter-

mined daily, and at the termination of each experiment, the animals were sacrificed, thyroids removed, fixed, sectioned and stained for follicular cell height and colloid production analysis.

Results:

(1) 3, 3, 5 triiodothyronine administration resulted in a significant elevation of the oxygen consumption rates as compared with the saline control group. Follicular cell height and follicular colloid content was significantly greater in the 3, 3, 5 triiodothyronine group than in the saline control group.

(2) When 3, 3, 5 triiodothyronine was followed by serpasil, a gradual but definite daily lowering of oxygen consumption rate was noted. Thyroids of these animals also showed a significant lowering of follicular cell height and lowered follicular colloid content.

*Serpasil, (reserpine preparation) kindly supplied to us by Dr. A. J. Plummer of Ciba Pharmaceutical Products, Inc.

Gonadal Histogenesis in The Couturnix Quail

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The Coturnix quail, **Coturnix coturnix japonica,** reproduces at the age of six weeks. Since this is the earliest known reproduction among gallinaceous species, it is felt that a critical examination of the gametogenesis and gonadal histogenesis of the Corturnix might possibly aid in advancing the knowledge of the unusual processes occurring in juvenile reproduction. Gonadal development is described in this study on the basis of gametogenesis, tubule and follicle formation, cortical and medullary development and regression, interstitial cell formation and general size of the gonads.

Three main points stand out clearly as being of possible significance in the early sexual maturity of the Coturnix. First, the appearance of interstitial cells, the presumptive producers of androgens and estrogens, occurs on the 7th day of incubation in embryos of both sexes. Second, the regression of the incipient cortex in the male is very rapid. Third, there is virtually no latent period between the occurrence of leptotene and pachytene threads in the maturation of primary oocytes.

Any positive statements concerning the exact hormonal relations in the early sexual maturity of this quail must await verification through a complete histological study and bio-assay of the

Coturnix pituitary. However, from the descriptive data accumulated and from known relations in other animals, it is concluded that the rapid gametogenesis and corresponding growth and differentiation of follicle and tubule tissue is probably caused by a general metabolic effect that is exerted by the pituitary and is manifest in the earlier-than-usual effect of the combined forces of gonadotropic and other hormones produced by the pituitary and acting on the gonads as well as on the body as a whole. Since the overall gonadal development is rapid, these actions are probably not exerted at one specific time, but rather beginning early, the action continues to build up to the ultimate of sexual maturity in the Coturnix quail.

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Some Notes on The Cytology of a Mouse Tumor— Sarcoma 1 Ascites

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The mouse tumor, Sarcoma 1 ascites, is currently carried in an inbred strain of mice in the biology laboratories at Alabama College. The tumor is maintained through intraperitoneal transplants into the appropriate host animals. This research project was an attempt to determine the pattern of mitosis within the tumor as well as determine the chromosome number which is characteristic of the tumor. Material for study was prepared using Sudan Black along with a smear technique. From prepared slides the total percentage of dividing nuclei was determined. A differential count of the mitotic figures was also made, that is, the percentage of prophases, metaphases, anaphases, and telophases was determined. Comparisons are made between these figures and similar data available on other tumors. The chromesome number characteristic for sarcoma 1 ascites and the variations from this number has been determined for purposes of comparison.

Some Helminth Parasites from an Alabama Rabbit

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On January 29, 1958, a cottontail rabbit, **Sylvilagus floridanus**, was killed by one of the authors (G. H. I.) in the vicinity of Cedar Bluff, Alabama. The following day this animal was necropsied and the worms listed below were recovered:

Trematoda

Nudacotyle novicia Barker, 1916; small and large intestine, and (?) heart.

Hasstilesia texensis Chandler, 1929; small intestine.

Cestoda

Cittotaenia variabilis (Stiles, 1895); small intestine.

Nematoda

Obeliscoides cuniculi (Graybill, 1923); stomach.

Trichostrongylus calcaratus Ransom, 1911; small intestine.

Trichostrongylus affinis Graybill, 1924; small intestine.

Trichuris leporis (Froelich, 1789); cecum.

Dermatoxys veligera (Rudolphi, 1819); large intestine.

Passalurus ambiguus (Rudolphi, 1819); large intestine.

The helminth of special interest in this report is the monostome trematode **Nudacotyle novicia**. This species was originally described by Barker (1916, Tr. Amer. Micr. Soc. 35; 175-184) from the intestine of a muskrat, **Ondatra zibethicus zibethicus.** It has subsequently been reported by Ameel (1944, Jour. Parasitol. 30: 257-263) from the meadow mouse, **Microtus pennsylvanicus pennsylvanicus,** in both natural and experimental infections, and the bog lemming, **Synaptomys cooperi cooperi,** in experimental infections. In both the meadow mouse and bog lemming the infections were restricted to the bile duct. Ameel also attempted to infect rabbits with this parasite but with negative results. Accordingly, the finding of **N. novicia** in a naturally infected rabbit constitutes a new host record.

Another point of interest with respect to this report of **N. novicia** from the rabbit is its apparent occurrence in the heart. Since this parasite in its normal host, the muskrat, occurs in the intestinal tract, its presence in washings of the heart of the rabbit was unexpected. Under ordinary circumstances the finding of a few specimens in the location mentioned could be ascribed either to post mortem migration of the flukes from the intestine through a shot injury or to contamination through carelessness during necropsy. In the present instance neither of these possibilities appears probable. No shot holes were observed in the heart or pericardium and the thoracic viscera was removed carefully so as to obviate possible contamination. The further fact that 900 specimens were collected from the heart washings and only 165 from the intestine (97 in the small intestine and 68 in the large) is strongly suggestive that either the heart or pericardial sac was the normal site of infection, possibly because the rabbit constituted an abnormal host for the parasite.

A Plea for More Seed Testing — An Interesting and Useful Career for Botany Students

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Available figures indicate that the present volume of seed testing in the United States is far from sufficient to insure adequate knowledge of the quality of marketed seed. Here is the application of many valuable research findings having direct benefit in the lessening of farm operating costs. Manufacturers make certain that the raw materials that go into their products are of dependable quality; seed may be considered the raw material of agricultural production, whether this is plants or animals. Seed analysis requires a working knowledge of botany, especially of taxonomy and plant physiology; it also requires the careful observation acquired through the discipline of botanical studies. The introduction of more botany students to the possibility of careers in seed testing, in either official or commercial seed laboratories, would create a source of trained personnel, and also provide many young people with an interesting and useful career.

SECTION II

CHEMISTRY

Syntheses in The Quinoline Series: Some Derivatives of 6-Bromo-8-ethylquinoline

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6-Bromo-8-ethylquinoline and some of its derivatives were prepared. An investigation of certain structural relationships among necessary intermediates as well as some of the derivatives of 6-bromo-8-ethylquinoline was also made. The results are summarized as follows:

1. 2-Aminoethylbenzene was acetylated to give 2-acetamidoe-

thylbenzene which reacted with bromine as formed in HBr-$HBrO_3$ mixture to yield chiefly 2-acetamido-5-bromoethylbenzene.

2. The structure of 2-amino-5-bromoethylbenzene, and hence that of 2-acetamido-5-bromoethylbenzene, was established by converting it into 2, 5-dibromobenzoic acid via 2, 5-dibromoethylbenzene. Since a range of values for the melting point of 2,5-dibromobenzoic acid is reported in the literature, an authentic sample of the acid was prepared from 4-amino-5-bromo-2-nitrotoluene, that was available in the laboratory, via 5-bromo-2-nitrotoluene, 2-amino-5-bromotoluene and 2, 5-dibromotoluene.

3. Additional evidence for the presence of the bromine in the 5- position in 2-amino-5-bromoethylbenzene resulted from the formation of 2-amino-5-bromo-4-nitroethylbenzene upon nitrating 2-amino-5-bromoethylbenzene followed by its conversion into 4-benzamido-5-bromoethylbenzene by way of 5-bromo-4-nitroethylbenzene. An authentic sample of 4-benzamido-5-bromoethylbenzene was prepared from 4-amino-5-bromoethylbenzene. This also served to establish the structure of 2-amino-5-bromo-4-nitroethylbenzene.

4. 4-amino-5-bromo-2-nitroethylbenzene was available in the laboratory from another study and this was converted into 2-acetamido-5-bromoethylbenzene via 5-bromo-2-nitroethylbenzene and 2-amino-5-bromoethylbenzene.

5. The conversion of 2-amino-5-bromo-4-nitroethylbenzene via 2-acetamido-5-bromo-4-nitroethylbenzene and 2-acetamido-5-bromo-4-aminoethylbenzene into 2, 4-diacetamido-5-bromoethylbenzene, that was also obtained by means of a similar sequence of reactions from 4-amino-5-bromo-2-nitroethylbenzene, further corroborated the structures of 2-amino-5-bromo-4-nitroethylbenzene, 2-amino-5-bromoethylbenzene and 2-acetamido-5-bromoethylbenzene.

6. 2-amino-5-bromoethylbenzene as formed from the hydrolysis of 2-acetamido-5-bromoethylbenzene was cyclized under the conditions of a modified Skraup reaction to give 6-bromo-8-ethylquinoline. Similar conditions were used for the preparation of 6-bromo-8-ethyl-5-nitroquinoline from 2-amino-5-bromo-4-nitroethylbenzene. These two ring-closures demonstrated that the bromine atom in 2-amino-5-bromoethylbenzene and the nitro group in 2-amino-5-bromo-4-nitroethylbenzene could not be adjacent to the amino group.

7. 6-Bromo-8-ethyl- and 6-bromo-8-ethyl-5-nitroquinoline gave the corresponding 2-chloroquinolines upon methylating, oxidizing

and reacting with a mixture of phosphorus pentachloride and phosphorus oxychloride. Hydrolysis of these 2-chloroquinolines yielded the respective 2-hydroxyquinolines.

8. Mononitration of 6-bromo-8-ethylquinoline, 6-bromo-2-chloro-8-ethylquinoline and 6-bromo-8-ethyl-2-hydroxyquinoline took place chiefly in the 5- position of the nucleus. Each of these nitro compounds were reduced and the resulting amines converted into acetamido and benzamido derivatives.

An Extrapolation Procedure For Determining Solubility

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Successive batchwise extractions of mixtures are used to predict the percentage of the more soluable components present. A plot of the amount extracted vs. the extraction number results in a section of a hyperbola which is then extrapolated to the limiting value. The solubility thus obtained is independent of arbitrary ratios of weights of solute to solvent. The method is applied to the determination of the alcohol soluble fraction of sugar cane wax, and a laboratory extractor operating at constant temperature is described. Also the method may be used to analyze other extraction data, eg., extraction with Soxhlet extractor, to determine the amount of soluble material left unextracted after a given time.

The Reactions of Niobium Oxychloride With Methanol

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Niobium oxychloride, prepared by reacting chlorine with a heated mixture of niobium pentoxide and carbon, was reacted with methanol and ethanol under anhydrous conditions and the products isolated. These were found to be of the type $NbOCl_2$ (OR).

The results of this study were correlated with the published findings of Bradley, et al on the metathesis of Group IVA and VA chlorides with the same alcohols.

Infra-red absorption spectra indicate the Nb=O structure to be present in the products prepared.

A Study of the Oxidation of Diphenylamine in Acetic Acid-Sulfuric Acid Mixtures

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While the "diphenylamine blue" reaction of diphenylamine and oxidizing agents was recorded in the literature in 1864 by Hoffman, many questions concerning its oxidation remain unanswered. The present study was made in mixtures of acetic acid-sulfuric acid using various amounts of hydrogen peroxide, potassium persulfate, ferric chloride and other oxidizing agents. Different reactions occurred as evidenced by blue, violet, green and blue changing to green colors. Transmittance curves were plotted when possible. The blue colors were developing so rapidly, we could not get reproducible curves with our spectrophotometer. Oxidation potentials were determined for some of the various solutions. An attempt is made to explain why the various colors appear and then some of them fade out or change to other colors.

The Role of the D. C. Analog Computor in Physical Chemistry

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Compared with other computing devices, d-c analog computers are often strikingly simple. The reason for this is in the relative ease with which the fundamental operation of multiplication by constants, addition, differentiation, and integration can be performed by utilizing simple basic laws of current flow.

Physical Chemistry has many problems that can be handled with the d-c analog computer. To illustrate the circuits for multiplication by constants and for integration, the ideal gas equation and the heat capacity equation will be set up and worked on a Heath D. C. Analog Computer.

The Test for Aluminum in Qualitative Analysis

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Since the year 1925 when Professors Hammett and Sottery first proposed the use of the ammonium salt of aurin tricarboxyllic acid to act in the "lake" test for incipient $Al(OH)_3$, the standard quali-

tative analysis manual has recommended the use of this so-called aluminon reagent. Many students obtain erroneous results because directions fail to specify the proper conditions for successful performance of the test.

A series of experiments has been performed to determine the optimum conditions of pH, the best types of buffer solutions to use and to find the degree of interference by other ions in the classical third group of cation analysis. Recommended directions for student use are given.

Attempts at the Synthesis of Sialic Acid

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Sialic acids are a group of amino sugars with nine and more carbon atoms and which possess a keto group in addition to an amino and a carboxyl group. The structure of the parent acid, the neuraminic acid, was determined by degradation. A definitive synthesis, which shows the configuration at the C4 and which would confirm the structure, still has not been accomplished. The results obtained by the application of several possible synthetic procedures will be discussed.

The Application of a Chemical Buffer to the Flame Photometric Determination of the Alkali Elements

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The effect of the hydrogen ion concentration on the resonance line intensities of the alkali elements was studied. Between the pH range of 1.0 and 4.0 the relative intensity is maximum and constant. below pH 1.0 and above pH 4.0 the relative intensity decreases. The effect of excess hydroxyl ion was also examined. By controlling the pH of the solutions with a buffer in the pH range from 1 to 4 the greatest sensitivity and accuracy was achieved.

Studies were made with synthetic samples containing known quantities of interferring substances as iron, aluminum, arsenic, magnesium, calcium, and silicate ion plus the alkali element. Detailed studies were made on the resonance line intensities of the al-

kali elements by varying concentrations of arsenic, and silicate ion.

The use of the buffer was applied to the flame photometric determination of the alkaline elements in various matrices. The buffer, citric acid-ammonium citrate, was applied to the analysis of the alkali elements in standards ores, refractories, clays, glasses, and human serum. The action of the buffering-complexing agent made possible the elimination of filtering and ion-exchange steps found in many procedures.

Synthesis in The Quinoline Series: Some Derivatives of 8-Chloro-6-ethylquinooline

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Some derivatives of 8-chloro-6-ethylquinoline were prepared, their structures verified and some of their properties determined. The findings are summarized as follows:

8-Chloro-6-ethylquinoline was prepared by subjecting 4-amino-3-chloroethylbenzene to the conditions of a modified Skraup reaction. The structure of 4-amino-3-chloroethylbenzene was verified by its conversion to 3, 4-dichlorobenzoic acid.

The nitration of 8-chloro-6-ethylquinoline gave a product which was shown to be identical with 8-chloro-6-ethyl-5-nitroquinoline obtained from a Skraup ring closure on 4-amino-5-chloro-2-nitroethylbenzene. The structure of 4-amino-5-chloro-2-nitroethylbenzene was verified by its conversion to 2-acetamido-5-chloroethylbenzene, which had previously been prepared in this laboratory and its structure established.

8-Chloro-6-ethylquinoline was converted into 2, 8-dichloro-6-ethylquinoline via the methyl sulfate salt and the 2-quinolone. The nitration of 2, 8-dichloro-6-ethylquinoline gave a product which was shown to be identical with 2, 8-dichloro-6-ethyl-5-nitroquinoline obtained from 8-chloro-6-ethyl-5-nitroquinoline via 8-chloro-6-ethly-1-methyl-5-nitroquinolinium methylsulfate, 8-chloro-6-ethyl-1-methyl-5-nitroquinolinium iodide, and 8-chloro-6-ethyl-1-methyl-5-nitro-2-quinolone.

The hydrolysis of 2, 8-dichloro-6-ethylquinoline with a refluxing sulfuric acid-water solution at atmospheric pressure gave 8-chloro-6-ethyl-2-hydroxyquinoline in good yield. Hydrolysis of 2, 8-dichloro-6-ethyl-5-nitroquinoline under similar conditions gave 8-chloro-6-ethyl-2-hydroxy-5-nitroquinoline which was identical

with the product obtained by the intration of 8-chloro-6-ethyl-2-hydroxyquinoline.

Catalytic reduction of 8-chloro-6-ethyl-5-nitroquinoline gave 5-amino-8-chloro-6-ethylquinoline. The acetyl and benzoyl derivatives of this amine were prepared.

SECTION III

GEOLOGY AND ANTHROPOLOGY

Fort Payne Chert—Warsaw Limestone Contact In Limestone County, Alabama

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The conformable contact of these lower Mississippian formations in Limestone County is characterized by a change in lithology and fossil content. Fresh exposures of the upper part of the Fort Payne chert are usually thin-bedded, light gray to bluish gray, fine to medium-grained limestone with nodules and layers of bluish-gray chert. The chert may make up 50 per cent of the exposed fresh rocks.

Fresh exposures of the lower part of Warsaw limestone are usually thick-bedded, light to dark gray, coarse-grained fossiliferous limestone. Chert is rare in fresh exposures.

Weathered parts of the Fort Payne chert and the Warsaw limestone are predominantly a vari-colored fossiliferous chert. The Fort Payne chert is usually bedded and contains an abundance of crinoid stems and Brachiopods. In contrast the Warsaw limestone chert occurs as rubble and contains an abundance of Bryozoa, Brachipods, blastoids and small crinoid stems.

The Fort Payne residuum is principally light brown to gray and contains an abundance of chert fragments. Warsaw residuum is characteristically red to brownish red with lesser amounts of chert fragments present.

A Burial Urn Site at Fosters, Alabama

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The Research Committee of the Alabama Academy of Science through a grant to the writer made possible the salvage excavation of a burial site at Fosters, Alabama. Valuable material was being destroyed in the construction of a dwelling in the center of the burial site. Although urn burials have been found along the upper reaches of the Alabama River within the state, the Fosters site is the westernmost record of such burials.

The analysis of the material indicates definite cultural relationships with the Alabama River area. Although no European trade material has been found at the Fosters' site, the designs on the urn cover would indicate an historical time period. The occupation of the Fosters site would be tentatively placed after the occupation of the famous Moundville site and some time before European trade had developed in west-central Alabama.

Fluctuation of Water Levels in Observation Wells In Madison County, Ala.*

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U. S. Geological Survey, Huntsville, Ala.

Many measurements of depth to water in wells in Madison County were made during 1950-58 as a part of the ground-water investigation by the U. S. Geological Survey in cooperation with the city of Huntsville, the Madison County Board of Commissioners, and the Geological Survey of Alabama. The purpose of the investigation is to relate the occurrence, quality, quantity, and availability of ground water to the geology of Madison County and to publish the resulting information to aid in the development of municipal, industrial, and domestic water supplies.

The rock formations that crop out in Madison County range in age from Ordovician to Recent and, in ascending order, include the following: Chickamauga limestone (Ordovician); Red Mountain formation (Silurian); Chattanooga shale (Devonian); Fort Payne chert, Tuscumbia limestone, Ste. Genevieve limestone, Gasper for-

mation, Hartselle sandstone, Bangor limestone, and Pennington formation (Mississippian); Pottsville formation (Pennsylvanian); and terrace deposits and alluvium (Quaternary). The Paleozoic formations dip gently to the southeast at about 20 feet per mile, except where abnormal structures exist.

The principal acquifers are limestone and chert, and they are especially productive where they underlie the valleys. Ground water in these rocks occurs in openings along joints and bedding planes that have been enlarged by the solvent and abrasive action of circulating water. These systems of openings serve as conduits for the movement of large quantities of water in the county.

An important phase of any ground-water study is the selection and maintenance of observation wells to determine the fluctuation of water levels. The observation wells in Madison County were selected on the basis of topography and geology. Water-level measurements were made biweekly in 8 wells, and automatic water-stage recorders were maintained on 3 wells from August 1956 through December 1958.

The water levels in the wells fluctuate chiefly in response to variations in precipitation and in discharge; and the magnitude of the fluctuation depends on the relation between recharge and discharge, on the location of the well with respect to areas of recharge and discharge, and on the size and extent of the solution openings penetrated by the well. Seasonal fluctuations of water levels observed during the investigation ranged from 4.5 feet in wells close to areas of ground-water discharge to 47.5 feet in wells close to areas of ground-water recharge.

*Publication authorized by the Director, U. S. Geological Survey.

SECTION V

PHYSICS AND MATHEMATICS

Experimental Demonstration of the Importance of Strain Rate Effects in the Propagation of Plastic Waves in Lead

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The propagation of impact stresses of sufficient magnitude to produce permanent deformation was studied in lead. Previous work by Johnson, et al, Riparbelli, Sternglass and Stuart, and Bell, with

aluminum and steel indicated that the rate of application and the state of pre-stress have an effect on wave propagation. However, these experiments were difficult to interpret quantitatively either because of a complex input wave form or because the strain was not measured as a function of time. In this study a step input was applied which could be analyzed mathematically using an extension on the treatments of Malvern and Rubin. The wave forms observed experimentally, i.e., the strains vs. time records at different positions on a long lead bar as obtained using circumferentially wound wire strain gages, were compared with theories including and excluding a strain-rate effect. Further, a definitive experiment was performed demonstrating the strain relaxation. The experiments showed that strain-rate effects are important in the propagatian of plastic waves in lead.

A New Geometry Proposition Demonstrated

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The sum of the squares erected on the sides of any triangle is equal to the square erected on the base plus or minus the rectangle formed with the base as one side, the adjacent side being a segment of the base lying between two lines of equal length passing through the vertex of the triangle and making with each other an angle equal to the supplement of twice the vertical angle of the triangle. This proposition consists of an extension and modification of the Pythagoren theorem to include triangles other than right triangles.

Mathematics in Latin American Universities

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Universities in Latin American countries are generally organized according to faculties, each of which has its own professors and administers it own courses. Since the universities are chiefly for professional education, the courses in mathematics are not offered as part of a general education program but are offered by the proper faculty. Mathematics for engineering or the physical sciences is

generally taught either in the faculty of engineering or in the faculty of physico-mathematical sciences. The faculty of economic sciences teaches its own courses in mathematics. A professor of mathematics may belong to more than one faculty. Typical professional degrees granted after a program in mathematics are engineer, licentiate, professor, or doctor. The course in mathematics offered in a faculty of engineering are the usual ones found in an engineering program. Faculties granting the doctorate in mathematics offer appropriate courses in higher mathematics. There are at some universities institutes of mathematics for research rather than for teaching.

ON THE GROUP OF TYPE P INFINITY

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The group of type p infinity is discussed from the standpoint of its realization as a rotation group. For a fixed prime p the group of type p infinity is defined to be the rotation group consisting of all rotations through angles x of the form

$$2k/p_n \text{ (Pi radians)},$$

where k and n are integers and n is non-negative. Letting x_n denote the angle obtained by setting k equal to 1 in the above expression and letting G_n be the cyclic group generated by x_n, the group of type p infinity may be expressed as the set-theoretical union of an ascending sequence, G_0, G_1, . . . G_n, . . . of its proper subgroups. Among the classical results presented is the fact that any proper subgroup of type p infinity is necessarily finite. This actually characterizes the group in the class of infinite abelian groups. In this regard the following open question is raised: what is the largest class of infinite groups for which the above property characterizes the group of type p infinity?

The Measurement of Instantaneous Velocity of Pulsatile Fluid Flow

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The Navier-Stokes equation is used to derive an expression for the velocity of a viscous, incompressible fluid in terms of the time derivative of the pressure pulse. The method is applied to blood

flow in canine aortas. The pressure is monitored by a catheter and a Statham pressure transducer. This signal is differentiated by an RC differentiator and fed to an analog computer which solves the specialized Navier-Stokes equation. The output of the computer is recorded and compared with simultaneous measurements of flow by the dye dilution method. The correlation coefficient between the two methods is .95.

Speculations on the Origin of the Gegenschein (or Countergrow)

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The Gegenschein is described as regards its size, shape, and spectrum.

Three theories which have been advanced for the explanation of the phenomenon are briefly discussed and criticized. They are the Schmidt atmospheric lens theory, the Moulton particle theory, and the Fessenkov atmospheric theory. Of these, the Fessenkov theory seems to be the most satifactory.

Mention is made of the author's attempts to partially explain the phenomenon on the basis of a focusing of the sunlight by the earth and its known atmosphere, although approximate calculations based on the diffraction, refraction, and relativistic deflection of light were highly unsatisfactory.

SECTION VIII

THE SOCIAL SCIENCES

The Alabama Freedman's Hospital

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The Reconstruction governments in the South made some positive contributions, particularly in the fields of education and social welfare where many of their measures forshadowed twentieth century developments. Alabama's maintenance of a Freedman's Hospital is a case in point.

When the Freedman's Bureau expired in January, 1869, the

former federal hospital, approximately two miles southeast of Talledega, was taken over by the state and care given to sick indigent Negroes who were domiciled there. No new patients were admitted during the six-year life of the institution and the number of persons served decreased from 73 on January 1, 1869 to 23 at the beginning of 1873. The annual appropriations decreased during the same period from $6,500 for 1869 to $3,000 for 1873.

Throughout its existence, the hospital had "very little sickness, aside from chronic cases, ulcerated extremities, etc., incident to old age, and the results of burns or accidents amongst the imbeciles."

To the trustees' credit each fiscal year saw the hospital operating in black. This was accomplished only by the most stringent economics, i. e. the attending physician salary was reduced to only $200 a year.

When the Democrats regained control of the Alabama government in 1875, the Freedman's Hospital was closed. Its patients were returned to their home counties where the probate judges were instructed to care for them as other paupers. "Bourbon" conservatism decreed that no similar welfare-state experiments should be undertaken. Not until after the turn of he century was the state to again venture into the establishment of another welfare institution.

Implications of Property Transferal Arrangements to Agricultural Efficiency in the Black Belt Region of Alabama

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Agricultural businesses have characteristically risen and fallen with each generation. Present day and prospective requirements as to resources, production efficiency, and managerial ability necessitate a departure from the patterns of property transfer between generations of past decades.

The data provided suggest that conventional arrangements can not only fail to facilitate but actually preclude a profitable business. The situation described focuses attention upon the need for planning of property transfer. The answers may be found to exist with sound inter-generation family farming arrangements and in the incorporation of more farm businesses.

Undergraduate and Graduate Programs for Sociology Majors and Minors in Alabama Colleges

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This paper assumes that teachers of sociology in Alabama Colleges and universities are vitally interested in improving the quality of their instruction, especally for students who are specializing in their field. It also assumes that any intelligent attempt to improve instruction must be based on as thorough knowledge as is obtainable of what is now being done in more than twenty (20) colleges in Alabama in which sociology is taught.

Fourteen institutions of higher learning in Alabama offered majors in sociology last year.

The colleges vary widely as to the specific courses demanded of majors. Only the introductory or general principles course is required by all. Not all Alabama colleges offering majors have programs for minors in sociology.

The only Alabama institution granting a graduate degree in sociology is the University of Alabama. At Auburn one may obtain a graduate minor in sociology if it is closely related to his graduate major.

A comparison may be made between the findings of this study and a survey of the sociology offerings of southern colleges made by Wiggins in 1955. The 12 most frequently offered courses in Alabama colleges were with one exception, the 12 Wiggins found most often in Southern colleges. This same study by Wiggins lists the major weaknesses of graduate student in sociology reported by their teachers.

Philosophical and Spiritual Sources that Help Define the Present-Day Ideology of Integration

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There is apparently a new ideology of integration being delivered to world consciousness through America's segregated minority. The component parts of this ideology can be seen in the current speeches and articles of Martin Luther King, its chief protagonist. King's philosophy embraces such concepts as: personal idealism, non-

violent resistance to evil, non-violent positive action, metaphysical justice, Christian love, and democracy. From these concepts the ideals and actions of the contemporary movement toward integration seem to flow. Brightman's personal idealism is used to justify a new Negro personality, which makes its appeal to world consciousness. In the area of technique, there is pronounced emphasis on Gandhi's passive resistance. There seems to be a synthesis of Thoreau's inclination to civil disobedience together with Christ's and Tolstoy's non-resistance to evil, resulting in a non-violent resistance to segregation, which can be effective in a Christian-democratic state. But it seems to be from Christ that King derives his greatest power, the dynamic of the **agape**, or Christian love, by which he seeks the social peace characterized by understanding good will. The emphasis is on moral forces. The goals are to improve the world, not just a segregated minority. The present-day ideology of integration, as seen from a comparative study of ideologies past and present, is a **mixtum compositum.** It is syncretic, embracing many things in one.

The "New States" Issue in Nigerian Federalism

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Nigeria, Africa's most populous country, will become independent on October 1, 1960. Among the problems with which it is likely to pass into independence are several connected with the federal arrangement agreed to in 1953. The federation consists of only three Regions — Eastern , Western, and Northern — and their size and constitutional powers constitute threats to the central government and national unity. In each Region there is an ethnic majority (ethnic and religious in the North) of about two-thirds and a minority of one-third. Each Region is governed by a party identified with the majority group, leading to minority grievances.

The "new states" issue is raised in two principal forms. The advocacy of a much larger number of states, less powerful, was seriously damaged in 1953 but is still earnestly argued. More influential is the claim for recognition as new states by certain minority groups in each Region. The 1957 constitutional conference created a commission to analyze minority fears and ways of allaying them, recommending the creation of new states only as a last resort. After intensive investigations the commission concluded that no case had been

made for any of the proposed new states (one each in the North and West, two in the East). Either they would contain dissentient minorities or would not be viable.

New states advocates renewed their arguments unabated at the conference in 1958 but got no satisfaction after the Colonial Secretary announced that creation of new states was incompatible with independence in 1960. The Western Region government party is championing the new states to broaden its support in the 1959 national elections and promises, if it wins, to reopen the issue before independence. This would create a constitutional crisis. If it does not win the new states issue will remain to plague independent Nigeria.

*The author studied federalism in Nigeria with the aid of a Ford Foundation grant in 1956-1957.

The Legal Delinquent: A Comparative Study

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The average textbook writer in the field of juvenile delinquency spends some twenty to thirty pages in an attempt to find a workable definition of a "juvenile delinquent." To clearly define the term "juvenile" is not difficult. There is also little or no difficulty in explaining the term "delinquent." Confusion seems to result only when these two words are viewed together. Perhaps a great deal of the misunderstandings pertaining to the size and scope of the problem of juvenile delinquency can be traced to the lack of a lucid definition of a true juvenile delinquent. One can hardly expect to bring the legal, social and psychological aspects of juvenile delinquency into one satisfactory meaning. With this in mind, only the legal concept of the juvenile delinquent is considered here. Over the past year and a half data have been collected from the forty-nine states, Puerto Rico and Hawaii including legal definitions of juvenile delinquency as set forth by these various states and territories. This information indicates that the lack of uniformity in the legal concept of juvenile delinquency is extensive.

Attitude Intensity and Self-Evaluation

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In a study of 77 students in a basic sociology course, the relationship between a measure of generalized intensity and the student's estimate of achievement in the course is examined. Previous research indicates that this relationship is curvilinear—U-shaped—and corresponds to the relationship usually found between intensity and attitude content.

Hypothesis 1. The mean intensity score for students who estimate their score on a quiz in the middle range is less than for those who give extreme score estimates. Statistical tests do not allow the rejection of the null hypothesis, although the results are in the predicted direction.

Hypothesis 2. High intensity scorers are more likely than low scorers to give extreme score estimates. The results of tests are not statistically significant, and the null hypothesis cannot, therefore, be rejected. The results of all tests of this hypothesis are in the predicted direction.

The sample size and weaknesses in the measures prevent these data from providing crucial tests of the hypotheses. The results suggest the feasibility of further research using larger samples and more refined measures.

Home Economic Research At API

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On the Home Economics faculty at A. P. I. we have full time research and part-time teaching and research personnel in housing and household equipment, textiles, marketing and nutrition on the experiment station, home economic department staff and family life in school of home economics. Dr. Katherine Philson is engaged in full time research on three projects important to the home-maker and professional home economist. Her study on: **Space Requirements for Clothing and Storage Designs for Farm Homes** is meeting a great many of the Farm Home makers problems in storing the family clothing, bedding, household cleaning appliances, home canned foods, Children's toys, men folk's boots, out door gear,

etc. Dr. Philson moved a family into a tenant house to make this study. She is using laboratory constructed free-standing, movable walls designed to serve as room partitions as well as storage.

Dr. Philson had a second project — **Body and Activity Measurements as a Basis for Designing Space, Facilities, and Equipment for the Home.** In this study she measured 50 women and 10 men to determine how much space was required in house planning to provide adequate comfort for normal routine Home activities, heights of kitchen cabinet shelves, built in dressing tables, desk etc.

Her third project is — **Thermal and Associated Conditions Related to the Operation and Use of Household Appliances** in which she is studying a method for comparing the Thermal effects of cooking processes. Her results to date indicate that such a method can soon be put into use in comparing the effects of various methods of cooking foods ordinarily prepared in homes.

In textile research Dr. Nell Glasscock is working to determine —**Reliability of Certain Laboratory Tests for Predicting In-Use Performances of Cotton Sheets Made From Cottons Differing in Fiber Elongation.** Sheets made from specially woven fabrics and placed in use in the A. P. I. Women's Dormitories will be laboratory tested during the period of wear and at the conclusion of this period, be analyzed to determine the relation of fiber properties to fabric performance in use.

Mrs. Mildred Van de Mark is tabulating data on the second phase of a Marketing and Nutrition study. — **Why Alabama Consummers Select Specified Meats.** This particular project includes a Major Food Group—meat poultry, fish and eggs in Alabama cities with a population of 10,000 to 25,000 inhabitants. Copies of the first phase of the study may be secured thru the A. P. I. Experiment Station.

Family life research is now full time in the School of Home Economics. Dr. Ruth Albrecht completed two challenging studies—one was a cooperative industrialization study in which she worked with the families of the men cooperating on the **Childersburg Pilot Study: A Survey of the Impact of Rapid Industrial Development on a Southern Community.**

The second study was a state project with the Alabama Experiment Station on **Formal and Informal Social Interaction of Rural Families in the Piedmont Area of Alabama.**

At the graduate student level it is gratifying to report that the

number of abstracts published in the Home Economics Journal and other professional magazines is evidence of the quality of their research.

Changing Personnel Practices in the Southeastern Spinning and Weaving Industry

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The study describes the extent to which some thirty personnel practices are used in the Southeastern spinning and weaving mills, and analyzes the changes which have taken place since 1952. The paper also weighs the influence which differences in number of employees, unionization, use of full-time personnel workers and/or of an organized personnel department, company structure and the location of company headquarters, in or outside the Southeast, may have upon these practices.

Material for the paper is drawn from two questionnaire surveys of Southeastern mills and from correspondence and interviews with mill officials. The first survey, made in 1952, covered 92 plants employing some 104,000 workers in six Southeastern states. The 1958 survey included 98 plants and 90,000 employees in seven states.

The study reveals a half dozen statistically significant changes in personnel practices have taken place in the industry within the last six years. The proportion of mills using full-time personnel workers has increased and also the percentage of mills engaging in personnel research. Testing is more widely used in employment and relatively more mills now have profit sharing programs. The number of mills with pension programs has increased greatly; however, the number renting houses to their employees has continued to decline.

Of the factors molding personnel practices which were investigated, personnel specialization, i. e., the use of full-time personnel workers and/or an organized personnel department, appears to have the most influence. Differences in number of employees and in company structure (i.e., single-plant firms vs. multiple-plant firms) are next in importance. Least influential are unionization and location of company headquarters.

SECTION IX

MEDICAL SCIENCES

Immunochemical Aspects of Tumor Therapy on Walker-256 Carcinosarcoma

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For the past 18 months we have been working on certain immunochemical applications of tumor therapy. We were attempting essentially to better understand the antigenic differences existing between normal and malignant tissues and to test the immune response by such tissues.

In this work, preliminary studies were undertaken with the Walker 256-carcinosarcoma. Rats were given tumor suspensions capable of ensuring 100 per cent 'takes." The tumors were excised, suspended in saline, separated from normal tissue and tested for antigenicity in rabbits and sheep. As the tumor suspensions were antigenic, antibodies were produced by the test animal. After exsanguination of the animals, serologic tests were carried out on the serum to determine titer and reactivity both to the tumor suspension and to normal rat tissue. By using a thousand-fold dilution technique, it was found that the highest titers were to the tumor suspensions and that normal tissue antibodies could be phased out. This led to the development of a means of absorbing out the normal rat cell antibodies leaving a high titered specific anti-tumor antibody preparation. Rats, with appropriate controls, were inoculated with Walker suspensions. Test rats were treated with anticancer serum and the rate of tumor growth compared to the untreated controls. While the serum did not prevent takes, it was found to significantly slow the appearance of the tumor. It was felt, on the basis of this observation, that it might be possible to greatly concentrate the antibodies, preferably in a dry, powdered form, so that constant reproducable results could be obtained. It was felt that a modification of Cohn's alcohol precipitation technique for isolating blood serum proteins might be useful. Initially 13 protein divisions were isolated, each of which were tested for their anticarcinogenic effect. Two fractions, one containing gamma globulins and the other lipoproteins, were able to either prevent takes, reduce tumor mass,

or to retard tumor growth. These fractions were also found to be nontoxic to the test animals. Further extensive modifications of the Cohn technique were worked out, and when applied to serum was found to yield a very pure gamma globulin preparation in a non-denatured form. On the basis of the animal experimentations, three inoperable patients with carcinoma of the breast were initially chosen to study the clinical effects of this procedure. The primary mass was removed and used as the antigen, antibodies were produced in sheep, normal human tissue antibodies were removed and the animal serum fractioned by the modified Cohn technique. Sensitivity tests were carried out on the patients and the appropriate serum fractions were administered. Supraclavicular nodes were measured before and after treatment, and as in the animal experiments, a reduction in tumor size was noted.

Pharmacy Schools in Alabama

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The history of pharmacy schools in Alabama parallels somewhat the industrial and scientific development in our state, as well as advances in medicine in the world.

The Medical College of Alabama, Mobile established a Chair of Pharmacy in 1882 and continued to teach pharmacy students until the college closed in 1920. It was a two-year course and there were usually about ten graduates per year.

Instruction in pharmacy was authorized by the Auburn Board of Trustees in 1885. In 1895, President W. LeRoy Broun, hired Emerson R. Miller to take charge of the department of pharmacy which offered the Bachelor of Science degree following the four-year course. In 1889, a two-year course was added which led to a certificate as a graduate pharmacist. In 1924, a three-year course was substituted for the two-year-course. Since 1932, the school has offered a four-year course leading to the degree, Bachelor of Science in Pharmacy.

When the Birmingham Medical College was established in 1894, a Department of Pharmacy was included. Three degree courses were offered: Graduate in Pharmacy, Pharmaceutical Chemist, and Doctor of Pharmacy. The school closed in 1915.

Mr. B. O. Shiflett organized a school of pharmacy in 1919 in Birmingham. The school was especially helpful in training individ-

uals who had had practical experience in a drug store but who had not had formal training in pharmacy. The Shiflett School of Pharmacy was closed due to the new law which became operative January 1, 1927 requiring pharmacy students to graduate from a Class A college of pharmacy.

President Guy Snavely inaugurated a department of pharmacy at Birmingham-Southern College in 1927. Mr. Shiflett having closed his School of Pharmacy became the nucleus of the new faculty. However, due to lack of funds the department of pharmacy was discontinued after two years.

The Trustees of Howard College voted in 1926 to establish a Department of Pharmacy. The department opened in 1927 and continued for four years. It was reestablished in 1932 and Dr. A. Richard Bliss became chairman in 1934. The department has continued to expand and offers both a four-year course and a five-year course.

Self-chosen Diets During Pregnancy and Health of the Newborn Infants for a Group in Birmingham, Alabama

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Data on the diets eaten by some pregnant women were obtained to determine a possible relation of the diet of the mother during pregnancy and the health of the infant. Data are reported for 30 primiparas who kept records of self-chosen diets for a 3-day period during each trimester of pregnancy. Medical data throughout the course of the pregnancy was obtained from the obstetrician. Information about the labor, delivery and physical condition of the infant at birth was obtained from the patient's hospital chart.

The nutrients in the estimated diets were rated excellent, good, fair, poor and very poor on the basis of the per cent of the recommended nutrient allowances which were contained in the diets.

The nutrient intake decreased each trimester of pregnancy. Vitamin A was the only nutrient which these primiparas consumed in greater amounts as their pregnancies progressed. Three maternal diets were rated as good, seven were fair, 14 were poor and four were very poor during the third trimester.

Four of the five babies who were rated poor by the pediatrician were born to mothers whose dietary ratings were poor or very

poor. There were no neo-natal deaths, still-births or congenital malformations in this group of infants.

Effects of Choline-Deficient Diets with Various Supplements on Nucleic Acid Content of Rat Livers*

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Sprague-Dawley (SD) rats receiving choline-free diet for five and 57 weeks had a markedly higher deoxyribonucleic acid (DNA) content in the liver than when the diet was supplemented with choline. Ethionine supplementation in the diet was more effective in increasing DNA content of livers of SD rats than a choline-deficient diet. The DNA increase caused by ethionine was not prevented by choline but was effectively prevented by methionine.

Ribonucleic acid was definitely less responsive than DNA to the diet changes studied.

*This work was supported in part by a grant from the National Cancer Institute.

Evaluation of Hemopoietic Effects and Inhibition of Mouse Sarcoma 180 in Young Mice: The Effects of Bis-Mesylates Related to Myleran

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In an attempt to relate steric factors to biological activity **cis**- and **trans**-1, 4-dimethanesulfonyloxy-2-butene and 1, 4-dimethanesulfonyloxy-2 butyne were prepared and their activities compared to that of Myleran (1, 4-dimenethanesulfonxybutane). The isomeric butenes were prepared, by a method to be reported elsewhere, with a geometrical purity of approximately 98% as determined by infrared spectroscopy. Studies in mice indicate a decreasing order of toxicity, 1 4-dimethanesulfonyloxy-2-butyne, Myleran and **cis**-1, 4-dimethanesulfonyloxy-2-butene, and **trans**-1, 4-dimethanesulfonyloxy-2-butene. Against Mouse Sarcoma 180 these same compounds showed a decreasing effectiveness as indicated: **trans**-1, 4 dimethanesulfonyloxy-2-butene, Myleran, 1 4-dimethanesulfonyloxy-2-butyne, **cis**-1, 4-dimethanesulfonyloxy-2-butene. Effects upon the hemopoietic system, as measured by decreases in peripheral WBC and bone

marrow changes, were least evidenced by the **trans**-2-butene derivative, most pronounced by Myleran while the effects of the 2-butene derivatives were intermediate.

An In Vitro Effect of Thyroxine on Gluconeogenesis

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Lindsay and Barker (1958) have shown that rat kidney cortex slices incubated in the presence of thyroxine maintained oxygen consumption at a higher rate in a Ringer-proline-glucose medium than in a Ringer-glucose medium. We have found that when kidney slices were incubated in a Ringer-glucose medium or in Ringer only there is a comparable net production of carbohydrate in both the control and the thyroxine-containing vessels for 1.25 hours at 37°. After 1.25 hours at 37° the carbohydrate levels declined, the greater quantitative decrease occurring in the medium with the added glucose. In a Ringer-proline medium thyroxine maintained the kidney oxygen consumption for 72 hours when tissue was incubated at 5° between the daily 1.25 hours manometric measurements at 37°, while the control tissue decreased after 24 hours. Under these conditions, the thyroxine-containing vessels showed a net gain of carbohydrate, identified as glucose, which increased daily over the 3-day period. The controls showed a net gain after the first 1.25 hours at 37° but no further increase once they were subjected to the 5°degree incubation. When the 37° incubation was continued for several hours, there was a net production of glucose for both the control and thyroxine vessels in the presence of a Ringer-proline medium. However, between 6 and 18 hours the carbohydrate levels in the thyroxine vessels were greater than the controls. This and other evidence suggests that thyroxine has some effect on kidney cortex gluconeogenesis from proline.

The Occurrence of Glycogen in the Adrenal Cortex of the Rat Under Different Experimental Conditions

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Various experimental procedures were tried to show the possible significance of the relatively large amount of glycogen in the adrenal glands of Long-Evans rats. Normally the greatest amount

of glycogen occurs during the week following weaning; thereafter the amount is variable, but it is rarely absent even in old animals. In the cortex it tends to be concentrated in the reticular zone with smaller and more variable amounts in the fasciculata. It is absent in the glomerulosa and in prepubertal male and female animals is practically absent in a narrow juxtamedullary zone. To test whether this juxtamedullary zone is an expression of sex hormone activity, one group of immature animals was castrated. Examination for glycogen subsequent to the time of usual disappearance of the zone showed no significant departure from the control picture. Giving testosterone for ten days to immature animals resulted in the practical disappearance of glycogen from all cortical cells making it impossible to identify the juxtamedullary zone. In other animals no significant difference in glycogen content was noted in glands taken at different estrous phases. Administration of either ACTH or epinephrine resulted in reduction of glycogen to half or one-third the usual amount. After ACTH was given, return to the control level occurred within 24 hours.

A Micro Pipette for Paper Chromatography and Electrophoresis

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A simple pipette can be assembled from the following parts: a broken pipette, the locking device from a Luer lock syringe, a hypodermic needle and some kind of cement such as Dekhotinsky. The apparatus described here was made from a 2/10 cc Kimax pipette graduated in 1/1000 cc. The locking device can be removed from a broken syringe by heating in a flame. The point of the needle is ground off by means of an emory stone so that the end possesses a flat surface perpendicular to the bore.

The pipette is inserted in the locking device and the cement placed around it so that the bore in the pipette is lined up with the bore in the locking device. Then the apparatus is placed in a clamp until the cement is set.

After attaching the needle in the locking device, it is bent to an angle of about 45°.

The pipette can be filled by suction and the size of the drop can be controlled by means of tilting the apparatus and by use of the finger. The size of the drop can be controlled by the gauge of the

hypodermic needle used. If the gauge number of the needle is very large, the flow may be quite slow.

This apparatus has been used successfully in our laboratory for applying spots on the paper strips for both chromatograms and paper strips for both chromatograms and paper electrophoresis. Dichromate cleaning solution cannot be used for clearing since the metal would be attacked. The type of cement used would determine whether the pipette would stand sterilization.

In conclusion: A simple, useful, pipette can be prepared from scrap equipment usually found in biological laboratories. The above apparatus might prove useful to workers who are on a limited budget, or who are operating out of personal funds.

Electrophoretic Separation of Mixtures of Galactose and Lactose

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Zone electrophoresis involves the application of an electric field across a strip of filter paper impregnated with a suitable conducting solution (Foster's Borate Buffer) on which a small amount of sugar is applied (5 microgram to 150 microgram). Time is allowed for the solution to dry. Then the buffer solution is added and allowed to equilibrate before voltage is applied. Positions of sugar zones on the paper may be detected by making use of either physical properties of the compounds such as ultra-violet absorption or chemical reactions such as reduction.

In this procedure advantage is taken of the ability of galactose and lactose to form borate complexes which migrate at different rates in the direction of the anode.

The maximum mobility of these complexes seems to be at pH's between (9 and 10). Under these conditions galactose has a greater mobility than lactose and the two compounds can readily be separated.

Samples have been run on aqueous solutions of equimolar mixtures of galactose and lactose. Varying amounts of the mixture from 20 micrograms to 100 micrograms were used. Good separation was obtained within four hours with an E.M.F. of 220 volts DC.

In the above procedure a method has been described for distinguishing galactose from lactose in aqueous solutions. The method has been successful on samples ranging from 20 micrograms to 100 micrograms. The method seems to have possibilities with even

lower concentrations of the above mixture. This is the case especially if a sensitive color reagent such as that of Consden's Aniline hydrogen phthalate is used.

Amino Acid Changes after Incubation of Rat Kidney Cortex in the Presence of Thyroxine

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Rat kidney cortex incubated in the presence of thyroxine at 5°C between measurements of oxygen uptake at 37° consumed oxygen at a higher rate than controls. Chromatographic analysis of the tissue and medium after three days of incubation showed the appearance of substantial amounts of amino acids in the medium and a decrease in the free amino acid content of the tissue. Five amino acids, leucine, phenylalanine, alanine, glycine and lysine, have been identified in the solution with glutamic acid also being present when proline was added to the medium initially. Tissue analyses indicated the presence of leucine, phenylalanine, tryptophan, alanine, glutamic acid, glycine, aspartic acid and lysine. There were also two unknown spots giving a color with ninhydrin but with characteristics different from any available simple amino acid. One of the unknowns seems to be glutathione. The concentrations of the various amino acids were determined by measuring the reflectance of the colored spots on paper chromatograms. The relative concentrations of the amino acids other than alanine, proline or glutamic acid were not altered by substrate concentrations of alanine or proline added to the medium before incubation. The presence of thyroxine resulted in lower amino acid levels in the solution and slightly higher levels in the tissue.

The Influence of Glucagon on Sugar Distribution in the Rat

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The one action of glucagon, both in vitro and vivo, about which there is good agreement, is that it promotes glycogenolysis in the liver. The question of its influence on peripheral utilization of sugar has led to contradictory reports.

It has been shown previously that when glucose at a level of 2 gm/Kg body weight is given intraperitoneally to a fasting white rat, there is a predictable amount of glycogen formed in the liver. When crystalline glucagon is given simultaneously with glucose via the intraperitoneal route of administration glycogenesis in the liver is delayed, but by 3 hours after the injection the glycogen content has reached its normal level. If, however, the glucagon is given subcutaneously at the time the glucose is given intraperitoneally, the delay in liver glycogenesis is much longer. Presumably its effect on other aspects of glucose metabolism is similarly potentiated.

Fasted white rats were given glucose intraperitoneally and crystalline glucagon either subcutaneously or into the peritoneal cavity. The animals were sacrificed 1, 3, 5 and 7 hours after administration and free sugar and glycogen were measured in liver, psoas and gastrocnemius muscle.

The results show that glucagon enhances glycogenolysis and depresses free sugar content of liver and blood. However, muscle glycogen content is significantly increased only when the glucagon effect is potentiated by a subcutaneous injection.

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Blood Volume Studies in Rheumatoid Arthritis

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In rheumatoid arthritis there is an anemia of questionable origin which has been held by some to be due to a hemodilution effect. In this study twenty-four male rheumatoid arthritics and a like number of normal male hospitalized controls (without arthritis and without disease states known to distort blood volume) were injected intravenously with 10 microcuries of I^{131} labeled human serum albumin. After 15 minutes equilibration time, a sample of whole blood was removed from the patient and the radioactivity of an aliquot of blood compared to that of a suitable prepared standard. The blood volumes obtained by the isotope dilution technique were expressed on the bases of volume per actual body weight, volume per "idealized" body weight, and volume per square meter

of surface area. In all parameters employed the arthritic group presented larger blood volumes than the hospitalized control group. The results expressed with Standard Error of the Means showed: Arthritics 87.4 ± 14.7 ml/kg actual body weight, Controls 77.1 ± 9.1; Arthritics 80.1 ± 10.6 ml/kg "idealized" body weight, Controls 75.6 ± 7.8; Arthritics 3.23 ± 0.42[1] sq. meter of surface area, Controls 2.98 ± 0.26.

Lipolytic Activity of Subcellular Fractions of Rat Pancreas

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Recently it has been shown by Desnuelle, Beck and Borgstrom, that pancreatic lipase catalyzes the hydrolysis of the primary alcohol groups of triglycerides. Others have found that lipase enzyme does not have very great specificity with regard to the fatty acids present in the triglycerides. Because all these studies have been made with very crude enzyme preparations, it seemed appropriate to conduct some substrate specificity studies with a pure enzyme preparation, if possible. The chemical fractionation procedures in the literature all result in 80-97% losses of lipolytic activity. The work reported here was an attempt at a preliminary subcellular fractionation of enzymic activity. In this manner it was possible also that we might separate the denaturing factor from the lipolytic enzyme. Without examination of subcellular fractions with electron microscopy, the purity of the fractions remains unknown; however, an indication of subcellular localization of activity has been obtained. A titrimetric assay procedure was utilized along with olive oil and tributyrin as typical lipase substrates. The subcellular fractionation procedure described by Schneider was used with the PR-2 International Refrigerated Centrifuge.

Myocardial Lesions in Rats Maintained on Diets Deficient in Choline*

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The effects of an inadequate intake of lipotropic factors on livers of various species and kidneys of rats are well known and have been extensively investigated. Pathological alterations occurring in other organs have received less attention. Myocardial necro-

sis has been noted by a number of investigators working with rats on choline-deficient diets. In most reports the authors have been concerned only with varying one constituent of the diet in type or amount and observing the influence of these changes superimposed on a choline deficiency. Results of work in this laboratory indicate that choline deficiency per se is the principal dietary condition essential for development of cardiac necrosis. However, the type and amount of protein and amino acids as well as lipid, and the proportions of these in the choline-deficient diet have a marked influence on the degree and intensity of the cardiac damage.

Valvular degeneration with or without calcification is a consistent finding in rats on diets low in choline. Myocardial degenerative changes appear to begin as a result of an accumulation of lipid within the myocardial fibers. This is followed by swelling and lysis, necrosis, and resolution with replacement by a minimal amount of fibrous tissue. Vascular involvement is often observed along with myocardial alterations. Slides will be shown to demonstrate the tissue changes observed in the investigation.

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Antithyroxine Effect of Some Thyroxine Analogs

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Thyroidectomized rats were given L-thyroxine subcutaneously at a dose of 20 ugm/kg/d for 3 weeks which maintained the BMR at about 20% above the hypometabolic level. The antithyroxine effect of a test compound was calculated according to its ability to reverse this metabolic maintenance effect. At an inhibitor: thyroxine molar ratio of 100:1, 3, 3', 5'-DL-triiodothyronine (2 mg/kg/d) depressed the BMR to its control level, thus showing 100% inhibition of thyroxine effect. The inhibition could be overcome by increasing the maintenance dose of thyroxine. However, at a higher dosage level, thyroxine 0.1 mg/kg/d and 3, 3', 5'-Trit 10.0 mg/kg/d, the efficiency of inhibition by 3, 3,', 5'-Trit fell to 50%. Among the other analogs tested, 3,3',5'-triiodothyropropionic acid, 3,3',5'-triiodothyroacetic acid and 3,3',-DL-diiodothyronine appeared to be equally effective as inhibitors. No significant antithyroxine effect was demonstrated with tetranitrothyronine, 3, 5-diiodothyronine, 3-monoiodothyronine, thyronine on 3,5-diiodotyrosine, up to a molar ratio of

200:1. Sodium iodide at a molar ratio 600 times the thyroxine produced no depression of metabolic maintenance.

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Effects of Ethionine and Triethylcholine on Rats Receiving Choline Deficient Diets*

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Investigations on the nutritional importance of choline have been pursued in this laboratory since 1938. In these studies it has been found that prolonged choline deficiency produces a significant incidence of tumors in rats. The first published report on this effect was by Copeland and Salmon in 1946. (Am. J. Path. 22:1059).

In order to produce choline deficiency in rats, without the use of an antimetabolite, it is necessary to use diets that are low in methionine. This raises the question whether the results of choline deficiency are complicated by a secondary inadequacy of methionine. In attempting to throw light on this, we have made use of ethionine which was shown to be an antimetabolite of methionine by Dyer in 1938 (J. Biol. Chem 124: 519). We have also used the triethyl analogue of choline. These studies have included growth experiments with rats and long-term experiments to determine pathological effects of the dietary treatment.

When choline deficient diets were supplemented with ethionine, there was marked depression of weight gains and survival time. There was partial alleviation of these effects of ethionine by dietary supplements of choline and/or methionine. However, certain combinations of ethionine, choline, and methionine supplementation increased the incidence of liver tumors over that produced by the standard choline deficient diet alone.

Low levels of triethylcholine in choline deficient diets depressed growth somewhat below that on the choline deficient diet alone but afforded significant protection against hemorrhagic kidneys and liver abnormalities. When the dietary level of triethylcholine was increased to 0.26-0.52% rats developed symptoms of muscular incoordination, spasticity and marked curvature of the spinal column. These symptoms were alleviated by administration of

acetylcholine or choline; they were prevented by 0.05% of choline chloride in diets containing 0.399% of triethylcholine.

*This work was supported in part by a grant from the National Cancer Institute.

The Pelvic Splanchnic Nerves of the Rhesus Monkey

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Male Rhesus monkeys were used in a study of the sacral splanchnic nerves (nervi erigentes). Gross dissections, histological examination, qualitative and quantitatve analysis of normal and selectively degenerated nerves, and electron microscopic studies of these nerves have been carried out to determine the origin, course, and number of the various components of these nerves.

The pelvic plexus receives parasympathetic and viseral afferent components from the sacral spinal nerves, sympathetic and visceral afferent fibers from the hypogastric nerves and sympathetic fibers from the sacral sympathetic chain via the pelvic splanchnic nerves. These sacral splanchnic nerves are usually two or three in number on each side arising from the first and second sacral nerves with a variable contribution from each segment.

The total number of nerve fibers in the pelvic splanchnic nerves are quite variable between the two sides of the same animal and from animal to animal and averaged approximately 16,000 nerve fibers with a stanard error of ± 600. Of these, approximately 8,000 to 11,000 are parasympathetic, the first and second sacral segments contributing about equally to this number. These sacral splanchnic nerves contain about 6,000 sensory and 5,500 sympathetic fibers and lumbar afferents included in these totals. The experimentally determined total number of fibers in the sacral splanchnic nerve of one side of approximately 19,000 may be compared with 16,000 nerve fibers in the normal nerves and falls within the standard error of the mean.

FULL LENGTH PAPERS

Some Experiments On Sawdust Pulping*

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Sawdust is considered unsuitable for the production of pulps for paper manufacture. Notwithstanding the technical difficulties of handling and processing sawdust and its generally high content of impurities, it is the low quality of the pulps obtainable with conventional pulping methods, that led to this attitude (1). Only chlorine dioxide gave pulps with acceptable strength properties (2).

This study was initiated as there were no experimental data available for an assessment of the Kraft process in pulping of sawdust from Southern pine and mixed hardwoods.

Experimental procedure

Sawdust of loblolly pine and of mixed hardwoods was obtained from a saw mill not later than 24 hours after operation. The trees were barked before being sawed. The sawdust was kept in airtight containers in the presence of a commercial fungicide and did not show deterioration after two months. The analytical data of the material used (kept on a 10 mesh screen and calculated on bone dry wood) were:

Percentage	Pine	Mixed Hardwoods
hot water soluble	1.25	7.85
1% NaOH soluble	10.25	22.10
alcohol-benzene soluble	0.80	5.04
holocellulose	64.10	65.00
lignin	31.80	22.30
pentosans		
ash	0.08	0.03

Digestion experiments were made in a 7 liter rotating stainless steel autoclave, electrically heated and temperature controlled to +1°C. At the end of the digestion period the pressure was released, the pulp washed with water at 60°C and immediately made into handsheets. All analyses and tests were made according to TAPPI-standard methods.

*Financial aid was given by the University of Alabama Research Committee

TABLE I

Cooking Experiments

Experiment No.	1	2	3	4	5	6	7	8	9	10	14	15	16
% total Na_2O	23.8	23.8	23.8	23.8	23.8	20.0	20.0	20.0	25.0	25.0	18.4	18.4	21.0
liquor ratio	4	4	4	4	4	4.4	4.4	4.4	4	4	4	4	4
g Na_2O/liter	59.5	59.5	59.5	59.5	59.5	45.0	45.0	45.0	64.0	64.0	46.0	46.0	52.5
temperature	160	160	140	150	140	140	140	140	165	165	140	140	165
heating time	30	30	30	30	30	30	30	30	40	40	30	30	40
time at temp.	60	30	0	30	60	60	150	180	240	280	120	150	240
yield	34.5	37.7	62.1	44.1	50.7	80.0	50.2	47.7	45.8	42.3	38.4	36.7	43.6
$KMnO_4$-No.	9.4	9.4	28.0	18.0	20.2	40	24.5	15.0	22.5	10.1	11.7	10.3	10.3
Lignin %	9.2	12.2	18.2	12.1	14.4	19.1	13.2	10.1	6.3	2.7	8.6	5.9	2.8
Pentosans %	5.1	5.2	8.8	5.9	9.4	--	6.7	5.3	8.8	9.3	7.2	7.4	11.9
beating time	70	70	—	70	70	—	70	70	65	55	45	45	45
C.-freeness	310	325	—	330	315	—	330	320	315	308	312	325	310
burst	32.8	36.6	—	21.3	20.9	—	33.0	29.6	80.0	71.6	53.7	64.0	91.2
tear	62.5	57.6	—	62.5	53.0	—	80.0	34.9	125	121	37	35	88
breaking 1.	3712	3650	—	4680	3900	—	6050	5780	9750	9400	4110	4325	688(
fold	21	24	—	83	44	—	208	625	1650	1530	98	115	364

1-8 pine sawdust; 9 and 10 pine chips, 14 and 15 hardwood saw-dust, 16 hardwood chips.

Results and Discussion

Regular Kraft pulps from Southern pine have permanganate numbers between 18 and 25, whereas bleachable pulps have P-N around 10. Kraft pulps with P-N in this region were obtained from sawdust, but their mechanical properties were much inferior to those of marketable pulps, as seen from table 1.

A normal Kraft cook of pine chips as shown in experiment 9 results in a good pulp with a P-N of 22.5 after 4.5 hours at temperature. At similar conditions in experiment 2 with sawdust a P-N of 9.4 was already reached after 30 minutes at temperature. The total yield was only slightly lower than the yield from chips but an analysis of the pulp showed, that this similarity exists only in the yield figures. The lignin contents were 12.2 and 6.3, the pentosan contents 5.2 and 8.8% respectively. These figures explain the differences in strength properties of pulps 2 and 9, as high lignin and low pentosan contents parallel with low strength.

The best pulp obtained from sawdust is pulp 7, which is comparable with pulp 9 from chips. At higher yield pulp 7 still contains 13.2% lignin, which is responsible for the lower strength of this pulp. Prolonged cooking time, i. e. time at temperature, gave pulp 8, which still contains much lignin and has lower strength properties than pulp 7 with the exception of the folding numbers.

TABLE 2

Percentage fiber retained by different screens.

No of experiment	5	7	8	9	10
No of screen	%	%	%	%	%
14	25	—	—	76	72
20		54	14	—	—
35	51	15	25	21	16
65	11	8	21	—	8
100	1	—	—	—	—
150	0	3	11	—	—
loss	12	20	29	3	4

TABLE 3

Lignin content of screen fractions of pulp 8.

Retained by:	% lignin
screen 20	10.1
screen 35	18.2
screen 65	12.5
screen 150	1.2

From the high lignin contents the conclusion must be drawn that the sawdust was not uniformly cooked. We classified therefore pulps 5, 7, 8, 9 and 10 in a Bauer laboratory classifier. The results in table 2 show clearly the high percentage of short fibers in sawdust pulps as compared with pulps 9 and 10, made from mill chips. If cooking is prolonged, the amount of short fibers and fines increases with both types of pulps.

A determination of lignin in the classified fraction of pulp 8 shows, that the highest lignin content is found in the longer fibers, as seen from table 3. This indicates, that during the first time of cooking only the small sawdust particles are reacting, whereas the larger ones are practically not attacked as seen from the unchanged lignin content. This fact makes it improbable that regular pulps can be obtained from sawdust without a remarkable loss in yield.

Handsheets made from classified fractions gave the expected drop in mechanical strength with decreasing fiber length as shown in table 4.

TABLE 4

Strength properties of pulp 8 and its screened fractions.

Screened fraction	Burst	Tear	Break	Fold	% of total
unscreened pulp 8	29.6	35	5780	625	100
screen 20	38.4	104	6220	780	14
screen 35	16.8	96	2320	590	25
screen 65	7.7	26	1050	78	21
screen 150	1.2	12	950	2	11

Conclusions

Our experimental results show indubitably, why Kraft pulps from sawdust are by far inferior to pulps from regular mill chips. The individual fibers are cut and damaged by the saw, so that even the screened sawdust gives a relatively low yield. After defibration the ratio of fines is very high.

The damage of the fibers by the saw is much more extensive as seen from the high lignin and the low pentosan contents of the sawdust pulps. The compression of wood, accompanied by local overheating causes irregularities in the wood structure, which are responsible for low uniformity of the pulps obtained, with low strength properties as the consequence. The conditions are similar to those found in pulps from chips of non-uniform size or from compression wood.

The reason short cooking periods can be used with sawdust

is that there is an easy accessibility of the cooking liquor to the primary wall.

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The Infrared Spectra of Fused Potassium Pyrosulfate Melts and Fused Niobium Pentoxide-Potassium Pyro-Sulfate Melts in the 2-15 Micron Region

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The pyrosulfate fusion for dissolving Nb_2O_5 has been widely used but little is known concerning the niobium species present in such melts. Adler and Hiskey (1), using ultraviolet spectrophotometric means, have demonstrated that freshly precipitated Nb_2O_5 will dissolve in conc. H_2SO_4 to form certain absorbing species but they postulated nothing concerning their nature. Sudarikov and Busarov (2) mention using niobium sulfate solutions in their study of the reactions of niobium with salicylic and sulfosalicylic acids, but they gave no formulas or mode of preparation for such niobium sulfates. This study was an attempt to use the infrared spectra in the 2-15 micron range of niobium-pyrosulfate fused melts to determine the nature of the niobium species present.

Experimental Procedure

Potassium pyrosulfate was produced by fusing at red heat in a porcelain crucible 2 g. of $KHSO_4$ to a clear melt. For the infrared studies of $K_2S_2O_7$ alone, the crucible containing this melt was removed from the flame, rotated rapidly to allow the melt to spread over the sides of the crucible and solidify, then placed in a Drierite filled dessicator to cool to room temperature. The solid melt, which separated easily from the crucible, was ground to a fine powder using a mortar and pestle. Two mg. of this powder was added to 400 mg. of dried KBr and the mixture ground to an exceedingly fine state of subdivision in an agate mortar. This mixture was pressed

into a solid wafer using a Beckman 6223 KBr die at 17 tons total ram pressure.

The Nb_2O_5-$K_2S_2O_7$ potassium bromide wafers were produced in the same fashion, with 0.5 g. of Nb_2O_5 being added to 2 g. of $KHSO_4$ and the melt heated at red heat until it was clear.

The infrared absorption measurements were made with a Perkin-Elmer Model 21 double beam infrared spectrophotometer with NaCl optics.

Discussion and Results

The spectra of fused $KHSO_4$ was examined first. It was assumed that heating $KHSO_4$ to red heat and open to the air would displace this equilibrium,

$$2\ KHSO_4 = K_2S_2O_7 + H_2O,$$

virtually to the right, thereby producing a melt of pure pyrosulfate. However, examination of the infrared spectra shows this assumption to be without foundation.

Fig. 1 shows that for such a melt, absorption peaks occur at the following wave lengths.

2.89	microns	(sharp)
3.36	"	(very weak)
6.12	"	(weak)
7.68	"	(strong and broad)
7.92	"	(strong and broad)
9.08	"	(very sharp)
9.51	"	(very sharp)
11.70	"	(very weak)
12.66	"	(strong and very broad)
13.52	"	(sharp)
15.32	"	(weak)

To assist in assigning the groups and structures responsible for these absorption lines Fig. 2 was prepared. This embodies the infrared spectra of a number of inorganic sulfate and hydrogen sulfate salts determined in Nujol mulls by Miller and Wilks (3), and Raman spectra of the di-, tri- and tetrasulfuric acids and their ionic species and sulfur trioxide as reported by Millen (4).

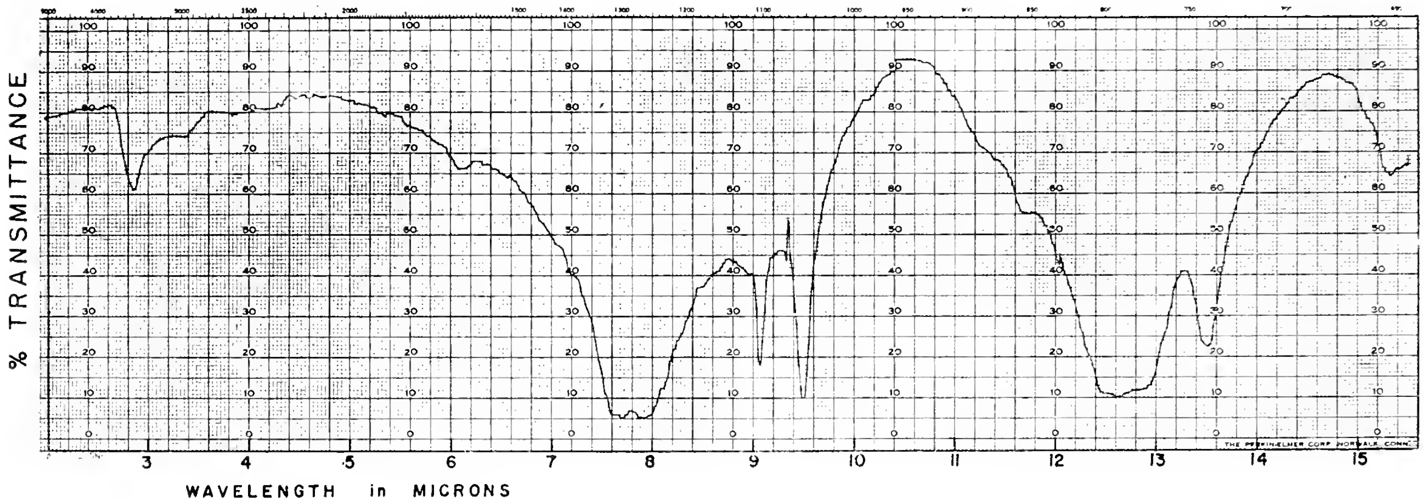

FIGURE - 1

Infrared Absorption Spectrum of Fused Potassium Pyrosulfate Melt in KBr Wafer.

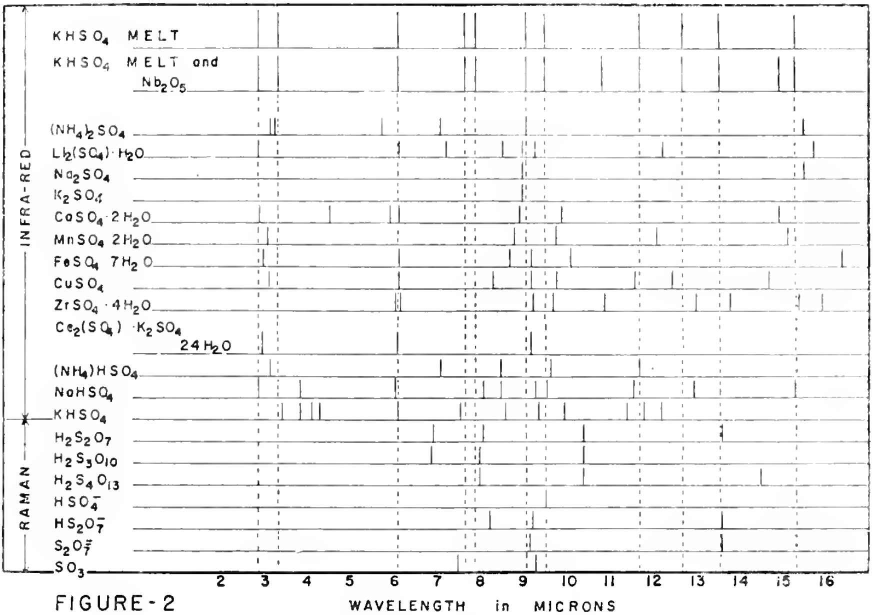

FIGURE-2

Comparison Of Infrared Absorption Spectra And Raman Spectra Of Sulfates.

The 2.89 micron peak is without doubt due to the OH stretching. Absorption is noted in this region for all hydrated sulfates. (Note—hereinafter Fig. 2 should be consulted for evidence of statements made). The OH stretching frequency in H_2O has been reported at 2.66 microns while in H_2O_2 it shifts to 2.78 microns (5).

It is interesting to note that this absorbtion peak, while present in $NaHSO_4$ is missing in $KHSO_4$.

The very weak absorption at 3.36 microns most likely is also due to OH stretching. It matches rather closely the 3.45 micron band in $KHSO_4$. Bellamy (6) states that OH stretching frequencies in chelate compounds having strong intramolecular bonds show broad bands between 3.1 and 4.0 microns. Colthrup (7) also has reported OH stretching to be possible between 2.7 and 3.4 microns.

The very weak band at 6.12 microns must also be associated with the OH band as it is present in most of the hydrated or acid sulfates.

Of all the sulfate salts only $KHSO_4$ shows an absoprtion peak that is close to the broad, strong peak noted at 7.68 microns in the spectra of the melt. Based upon a Raman line at 7.5 microns this

would indicate the SO_3 group. One of the four oxygen atoms about the sulfate group must be at a greater distance from the sulfur than the other three in $KHSO_4$ and in the melt. More evidence for this fact is to be noted in the missing 2.8-2.9 microns line for $KHSO_4$ which shows the OH distance is not equivalent to that in the other sulfates. Also the characteristic 9.1 micron sulphate ion line is missing for $KHSO_4$.

The very broad 7.92 micron band would seem to indicate the presence of the pyrosulfuric acid group (the disulfate ion) since it matches somewhat the Raman line at 8.1 microns. This section of the spectra could not be resolved too well and this particular band extends from about 7.85 to 8.08 microns. Why in $NaHSO_4$ alone of all the salts this absorption band should be noted is certainly puzzling.

The very sharp and characteristic 9.08 micron and 9.51 micron peaks are due to the sulfate and hydrogen sulfate ions, respectively. Actually these bands are related to the S=O bond (8).

The very weak absorption band found at all 11.7 microns is observed only for $CuSO_4$, $NaHSO_4$ and $KHSO_4$. Although the $CuSO_4$ was reported to be anhydrous, it is known that the last water molecule is very difficult to remove. This 11.7 micron line therefore must be related to the hydrogen sulfate ion.

The 12.66 micron peak bears no apparent relationship to any known group, and hence cannot be identified with our present information.

The 13.52 micron peak correlates quite well with the Raman lines noted for the hydrogen disulfate ion.

At 15.32 microns the weak absorption is considered to be due to the O=S=O group as based upon the findings of Colthup (7). It is to be noted that the absorption in this region is greatly influenced by the nature of the positive ion associated with the sulfate group.

It can be concluded that the melt produced by heating $KHSO_4$ contained both hydrogen sulfate and disulfate (pyrosulfate) species. This bears out the findings of Hagesawa and Taki (9) in that a definite eutectic mixture results when $KHSO_4$ and $K_2S_2O_7$ in a 19:1 ratio are heated together.

Based upon the presence of the 13.6 micron band in the Raman spectra of pyrosulfuric acid, the hydrogen disulfate ion, and the disulfate ion only, it might be concluded that it is due to the S-O-S bond. The absence of this band in the tri and

tetrasulfate species is disquieting, yet it is not found in any other sulfate species but those with a S-O-S bond. This band is shifted toward lower wavelengths (13.52 microns) in the melt, which would indicate an increase in strength as compared to the acid species. This is in line with the statement of Flood and Forland (10) to the effect that the polarizing power of the cation influences the strength of the S-O-S bond in pyrosulfates, and that potassium ions produce the most stable pyrosulfates.

The 10.4 micron band, which is missing in the melt, would indicate species higher than the disulfate to be absent. The trisulfate decomposes into the disulfate and SO_3 above 150 degrees C. (11).

The infrared spectra of the pyrosulfate melt containing Nb_2O_5 was identical to the $KHSO_4$ melt except for two new absorption bands at 10.84 microns (a shoulder) and 14.96 microns (weak). The 10.84 micron band indicates the presence of the Nb=O group and has been noted in many other niobium compounds (12).

At present no conclusions can be expressed regarding the 14.96 micron band, though it most likely bears a relationship to the Nb present in the melt.

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The Commonwealth Parliamentary Association: A Political Institute of the Commonwealth of Nations

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One of the most interesting political units in the world today is the Commonwealth of Nations—a group of independent states which is bound together by vague and apparently loose ties and which has grown out of the British colonial system. Ten states are now independent members of the Commonwealth. They are the United Kingdom, Canada, Australia, New Zealand, the Union of South Africa, India, Pakistan, Ceylon, Ghana, and Malaya. The last five have all received their independence and Commonwealth status since the Second World War. The expansion of the Commonwealth has not stopped. Other parts of the British organization are well on the way to independence and presumably to Commonwealth status, e.g., Nigeria, the Federation of Rhodesia and Nyasaland, and the West Indian Federation.

The Commonwealth tends to be a particularly puzzling arrangement to the average American. Here are several autonomous and independent states which have formed an organization without an organization, if I can thus express it. There is no constitution, no legislature, no governing council. There is no significant organization which joins the members together and holds them together. Each member is completely independent in its internal and external affairs. Members may and do pursue conflicting policies. There are vast differences between the various members: differences of geography, of social customs, of history, of race, of language, of economic development. Yet in spite of these vast differences and in spite (or perhaps because) of the lack of organization, the Commonwealth is a fact and membership in it and its continuation is regarded as important by all of the present members. Furthermore, areas which are moving toward independence look toward remaining within the Commonwealth system. Why is this so?

Undoubtedly there are many reasons and all of them cannot be examined in this paper. Some of them may be suggested. The older members of the Commonwealth have a strong sense of loyalty toward Great Britain and wish to retain their association with her. This is especially true for Australia and New Zealand. All of the members recognize that Commonwealth membership has advantages

for them. The United Kingdom is aware that its power is greater because it is the head of the Commonwealth group than would be the case if it were just the British Isles plus remaining colonial possessions. In many instances, Britain speaks for other member of the Commonwealth in international negotiations. India can acquire information about international affairs through the flow of cables and reports which pass between Commonwealth members and which would not be available to her if she were not a member. Membership helps to raise the status of a new nation like India in her diplomatic dealings, especially when she is negotiating with the United States. All but one (Canada) of the Commonwealth nations base their currencies on sterling and belong to the Sterling Area. Sterling helps to unite those states and economic advantages result from belonging to the Commonwealth.

One of the principal unifying factors in the Commonwealth is the fact that all members have patterned their governmental organization upon the parliamentary form of government. Each government is, of course, not an exact replica of the government of the United Kingdom but each one has the basic form of a parliamentary system, a system which it learned during its period of dependency. These many parliaments are now joined in a Commonwealth Parliamentary Association. This Association unites branches formed in the legislatures of the various Commonwealth countries and, thus, serves to unite the diverse states of this multiracial Commonwealth.

Other important Commonwealth institutions are the Prime Ministers' Conferences, Foreign Minister's Conferences, Finance Ministers' Conferences, Defense Ministers' Conferences, and various technical groups such as the Commonwealth Economic Committee, the Commonwealth Agricultural Bureau and the Commonwealth Air Transport Council. The Commonwealth Parliamentary Association is, however, the subject of this paper. It is the author's contention that this is an important institution in helping to hold the Commonwealth together and that an examination of its operation reveals a good deal about the Commonwealth.

The Commonwealth Parliamentary Association was begun in 1911. It originated in a suggestion made by L. S. Amery in connection with the coronation of King George V. Mr. Amery proposed that "His Majesty's faithful Commons from each part of the Empire should, by delegation of their members, be present at the Coronation." When these delegations assembled in London, the

Association (then called the Empire Parliamentary Association) was born. It began with six branches.

In 1913, a delegation of sixteen members from the United Kingdom visited Australia as guests of the Australian Branch conferring with other branches en route. An Empire Parliamentary War Conference was held in 1916 and after the First World War, it became the aim of the branches to arrange a full conference of delegations at frequent intervals. Conferences were held in Australia in 1926 and in Canada in 1928, the first to be held outside of the United Kingdom. Several smaller conferences were held in the 1930's. The two most important conferences before the Second World War were held in London in 1935 at the time of the Jubilee of George V and in 1937 at the time of the coronation of George VI. Since the war, Commonwealth Parliamentary Conferences have been held in London in 1948; in Wellington, New Zealand, in 1950; in Ottawa, Canada, in 1952; in Nairobi, Kenya, in 1954; and in New Delhi, India, in 1957. The Association has been named the Commonwealth Parliamentary Association since the 1948 meeting.

The Association is composed of branches formed in the legislatures of the various Commonwealth countries. Main branches are formed in the national parliaments of independent member countries of the Commonwealth; state and provincial branches are formed in state or provincial legislatures within member countries of the Commonwealth; auxiliary branches are formed in legislatures of countries under responsible government but which are not yet fully self-governing; and affiliated branches are formed in legislatures of any other parts of the Commonwealth under responsible or representative government.

The Commonwealth Parliamentary Association is governed by a General Council which consists of two members from each main branch and one member from each regional group of other branches. The headquarters of the Council are in London. Its main task is to organize conferences and to serve as a center for the issue of publications and for research and information on current Commonwealth affairs for the members of all branches.

Each branch is autonomous and has its headquarters in its parliamentary premises. The branch presidents are normally the presiding officers of the legislatures. A member of any legislature where a branch has been formed is entitled to become a member of the Association. Members who cease to belong to a legislature may become honorary members or associates.

Provision is made for the formation of "Associated Groups" in

the legislatures of countries which are not part of the Commonwealth but which are closely connected with it by reason of common parliamentary practice or tradition, common language and interests, or past political relations. Such groups have been formed in the United States Congress and the Irish Parliament, two former members of the British Empire. (1).

The organization of Commonwealth Parliamentary Conferences is a major activity of the Commonwealth Parliamentary Association. These conferences normally take place every two years. As noted above, five conferences have been held since the Second World War, the last one in New Delhi, from December 2-10, 1957, with India, Pakistan, and Ceylon joint hosts. The author observed several sessions of this Conference and wishes to discuss the significance of the Commonwealth Parliamentary Association to the Commonwealth from the aspect of this Fifth Conference.

This Conference was the first one to be held in Asia. The growing importance of this area to the Commonwealth was thereby indicated. Representatives of over sixty branches attended. There were even three members of the United States Senate — Wayne Morse of Oregon, Thruston Morton of Kentucky, and Frank Carlson of Kansas (2).

The following areas were represented: United Kingdom, Northern Ireland, Isle of Man, Canada, Australia, New Zealand, Union of South Africa, India, Pakistan, Ceylon, Ghana, Federation of Malaya, Federation of Rhodesia and Nyasaland, Malta, Federation of Nigeria, Bermuda, Bahamas, Jamaica, Barbados, Trinidad, British Guiana, Kenya, Singapore, Sierra Leone, Mauritius, Gambia, Windward Islands and Uganda. Canada, Australia, India, Pakistan, Rhodesia and Nyasaland, and Nigeria had representatives from both the central government and the states or provinces.

Some well known parliamentarians were present. The delegation from the United Kingdom was particularly strong. It was led by Derick Heathcoat-Amory who was then Minister of Agriculture, Fisheries and Food in Harold MacMillan's cabinet and is now the Chancellor of the Exchequer. The Leader of the Labour Party, Hugh Gaitskell, was deputy leader of the delegation. Another outstanding member of this ten-man delegation was Patrick Gordon-Walker who was Secretary of State for Commonwealth Relations in the Labour Government from 1950 to 1951. Since the conference was held in New Delhi, it was logical for the Indian delegation to be headed by Prime Minister Jawaharlal Nehru. This delegation included other leading members of the Indian Parliament, the best known

being T. T. Krishnamachari, then Finance Minister. Pakistan did not send her prime minister but this delegation was led by Syed Amjad Ali, the Minister of Finance. S. W. R. D. Bandaranaike, the Prime Minister of Ceylon, led his country's delegation. The chairman of the General Council of the Association and, therefore, the presiding officer at the sessions was M. A. Ayyangar, the Speaker of the Lok Sabha of the Indian Parliament.

The delegates discussed such topics as economic relations in the Commonwealth, underdeveloped territories of the Commonwealth, the party system in Parliament, social services in the Commonwealth, the future of the smaller states in the Commonwealth, the role of the English language in the Commonwealth, and international affairs and defense.

The first two topics — economic relations and underdeveloped territories — had points of similarity and the discussion tended to overlap. Major statements were made by Heathcoat-Amory of the United Kingdom, T. T. Krishnamachari, the Finance Minister of India, Syed Abjad Ali, the Finance Minister of Pakistan, and E. A. Vasey, the Minister for Finance and Development of Kenya. Much emphasis was placed upon the necessity of the Commonwealth nations helping each other by intra-Commonwealth trade and by providing capital for the development of the underdeveloped and developing areas. The responsibility of the United Kingdom to aid in the economic development of the Commonwealth countries was underlined by the representatives of the countries needing such aid and this responsibility was accepted by the British delegation while explaining the difficulties Britain is under in raising the capital to meet the demand. Finance Minister Krishnamachari dwelt at length on India's two Five Year Plans and on the absolute necessity for outside capital to carry through the Second Five Year Plan. The importance of the Colombo Plan to the economic development of the Asian area of the Commonwealth and the contributions which the United Kingdom, Canada, Australia, and New Zealand are making through this plan were pointed to by representatives from these older members of the Commonwealth. An Indian delegate remarked, however: "Let me tell my hon. friends from Canada, Australia, New Zealand, and England which are more developed than us and more rich than us, that the contribution that they till now have been making is not at all adequate for the development of the other areas of the Commonwealth." (3).

The principal statement on the party system in Parliament was made by the Ceylonese Prime Minister, S. W. R. D. Bandara-

naike. He raised questions about the working of the party system where there was a Parliament with either a multi-party system or a single dominant party with no effective opposition. Most of the discussion centered around such problems of the party system with concern being varied about the party systems in the new Asian and African members of the Commonwealth.

In the discussion of the social services in the Commonwealth, the delegates shared with each other the programs of their various countries and the problems connected with them. This was probably the least interesting session. As one British delegate remarked "This looked a very attractive subject from London, but it is not so attractive now, because we see things from a very different perspective here." (4). He went on to point out that it was very difficult to discuss this subject in common terms because of the wide differences in the level and scope of social services among the nations represented.

The subject of the future of the smaller states in the Commonwealth produced a vigorous discussion about possible courses of development of the small states. Some delegates asked for a speeding up of the time-table for independence for their countries others wondered whether some of these areas could be independent and viable. Consideration was given to grouping several of them in a federal arrangement like that of the West Indian Federation. Patrick Gordon-Walker from the United Kingdom put the problem as follows: "There are some States in the world that are not big enough to be full nations and to sustain the elaborate apparatus of nationhood. And the problem arises about what you do with the smaller States which fall, so to speak, on the wrong side of this line." He advised his fellow delegates that this was not solely a problem for the United Kingdom, but it was a problem for other parts of the Commonwealth also. (5).

A subject of considerable interest was the role of the English language in the Commonwealth. Patrick Gordon-Walker characterized this as a difficult, delicate and explosive subject. (6). Debate about the English language in the new Commonwealth states raises tempers and blood pressures. This is especially true in India, Pakistan, and Ceylon. New and tender nationalisms have produced reactions against continued use of English as the language of government and demands for reliance upon native languages. The fact that a single native language unites all the people of these states together causes difficulties. In concluding the discussion, Patrick Gordon-Walker suggested that the farther in time the new Com-

monwealth nations got away from independence, the easier this problem would be to face because the people would get confidence that they were not speaking the English language of England but were speaking their own English. (7).

The conference spent the most time in discussing international affairs and defense. The principal speeches were given by Hugh Gaitskell, the British Labour Party Leader, by Wayne Morse from the United States Senate, and by Prime Minister Nehru of India. It was a wide-ranging discussion which covered many controversies and problems in international affairs. The discussion clearly revealed that there is no uniform Commonwealth foreign policy and that there are many differences of approach between the different members. Mr. Gaitskell and Senator Morse generally presented the attitudes of the United Kingdom and of the United States while indicating that they did not agree with all the policies of the present governments of their countries. Mr. Nehru put forth the Indian approach and his opposition to the continued reliance of the West upon pacts. He indicated particular displeasure with SEATO and the Baghdad Pact. In summation, Mr. Gaitskell suggested that although there were points of difference, there were also basic points of agreement and these he found more significant than the disagreements. ". . . we as an Association could not justify ourselves unless we do have some common ideals and these common ideals, I think, have been expressed many times during the course of the debates. If in this international scene we can work together even without complete unanimity, each of us . . . playing his part to achieve those ideals, then we shall have made a very real contribution to the peace of the world and justified this Conference and future Conferences as well," (8).

The subject matter of the Fifth Commonwealth Parliamentary Conference and the level of the discussions indicate how important the Commonwealth Parliamentary Association through its conferences is in the Commonwealth organization. The Association does not claim credit for any constitutional change, for any far-reaching legislative enactment, or for even as much as a resounding resolution. As Mr. Heathcoat-Amory said: "We are assembled here, Mr. Speaker, not as representatives of Governments having executive powers of decision or action. We are here as Members of Parliament. Our task is to discuss these problems, to share our thoughts and to face honestly the differences of opinion where they exist, when necessary agreeing frankly to differ and yet whenever we can seeking to reach accord. Whenever we find common ground, as we

so often do, let us rejoice in doing so and then let us return home and pass on the result of our deliberations to our colleagues in Parliament and in our Government." (9).

By coming together and talking about common problems, formally and informally, by getting to know one another, by seeing the various countries of the Commonwealth and learning of their problems, of their successes and of their failures, each of these delegates is bound to learn a lot and to go home with a perhaps changed outlook on the Commonwealth or at least as a better informed person. It is encouraging to know that representatives from such widely different political units can sit down and calmly discuss mutual problems. It is good to know that men and women, white, brown, and black, dressed in many different costumes, coming from many different backgrounds, but all speaking English and all united because they represent the parliaments of Commonwealth countries can carry out such discussions. The conferences of the Commonwealth Parliamentary Association reveal that the Commonwealth of Nations has great vitality.

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Studies of the Morphology of the Normal Chromosome Compliment and Temperature Effects Upon the Rate of Mitosis and Growth in Onion Root Tips

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In observing onion root tips nuclei Kurita (1) found that of the 32 chromosomes (4N) observed, 28 had a median or sub-median spindle insertion; the other 4 were sub-terminal. Each of the latter had a trabant at the end of its shorter arm. Other than this information, few studies on the morphology of the normal chromosome complement of the onion could be located, although the chromosome morphology of many other plants is available, examples of which include **Trillium** (2, 3, 4, 5), **Lilium** (6), **Medeola virginiana** (7) and **Vicia faba L.** (8).

A recent study has been made dealing with the temperature effects upon the rate of mitosis and the rate of growth in root tips of **T. sessile L.** (9). As a result of this study, Bailey points out that maximum increase in the length in root tips of **T. sessile L.** took place at a temperature of 24° C., whereas the maximum number of dividing nuclei was found at 15° C. This study also indicates that there was another peak in the number of dividing nuclei. This peak was found to be at 1° C. where almost as many nuclei were dividing as at 15° C. However, at 1° C. there was very little increase in length such as took place at 15° C. Also at 15° C., where the maximum number of dividing nuclei was found, there was less increase in length than at 24° C. At 15° C., 14.8% of the nuclei was in some stage of mitosis with an average increase in length of 3.7 mm. over a 96 hour period. At 24° C., 9.8% of the nuclei was dividing, whereas increase in length over a 96 hour period was 8.2 mm. At 1° C., 13% of the nuclei was in some stage of mitosis with an average increase in length of approximately 0.7 mm. over a 96 hour period.

Bailey attributes this increase in the number of dividing nuclei at lower temperatures, where very little increase in length took place, to a "slowing down" of the spindle mechanism at metaphase. A breakdown of the total number of dividing nuclei into the conventional prophase, metaphase, anaphase, and telophase stages, shows this to be true. From the data furnished by Bailey, it is evident that these low temperatures do not completely inhibit the earlier stages of mitosis, but simply form a metaphase block. At 1° C., in **T. sessile L.**, approximately the same percentage of nuclei

was found to be in prophase as for other temperatures, whereas the percentage of metaphases was considered greater.

Between 9° C. and 33° C., approximately 0.5% of the dividing nuclei was in metaphase, whereas at 1° C., 19.7% of the nuclei was in metaphase.

Bailey points out that the mitotic figures appear to be normal after exposure to temperatures between 1° C. and 33° C. for 96 hours. At temperatures of -3.0° C., 36° C., and 39° C. for periods of 96 hours, the mitotic figures appear to be abnormal; and studies on recovery indicate that root tips of **T. sessile L.** fail to survive these temperatures for 96 hours.

This study is an attempt to determine the normal chromosome complement (2N) of the onion **(Allium** sp.) and the influence of various temperatures upon the rate of growth in root tips of **Allium** sp. and upon the rate of mitosis within these root tips.

Materials and Methods

Fresh-growing root tips for study were obtained by removing the outer two or three layers from well-matured bulbs and all old, dried roots; supporting these bulbs over distilled water in beakers, using toothpicks inserted in the sides of the bulbs for support; and incubating at a constant temperature of 24° C. until fresh root tips appeared. For studies on the effects of temperature upon growth and upon the rate of mitosis in the root tips, onions with fresh growing root tips were maintained at a constant temperature of 24° C. for 48 hours. These onions were then exposed to temperatures of 0° C., 6° C., 12° C., 18° C., 24° C., 30° C., and 36° C. for periods of 48 hours. Measurements of increase in length during the 48 hour exposure period to the different temperatures listed above were made in terms of millimeters. These measurements were made by placing India ink markings 10 mm. from the tip before the 48 hour exposure period. After each exposure the tips were then measured again to determine the increase in length. The average increase in length for each temperature was determined from these measurements. The onion exposed to 0° C. was allowed to recover for 48 hours at 24° C.

Slides for study and actual counts of the mitotic figures were prepared from the root tips using the Feulgen technique together with a squash method (10).

Measurements were made on metaphase chromosomes using an ocular micrometer with a 10x ocular and a 97x objective.

Counts of mitotic figures were made using a 10x ocular and a 43x objective. The number of dividing nuclei was determined by actually counting the number of nuclei undergoing some stage of mitosis within a root tip approximately 1 mm. in length, and the percentages of dividing nuclei were determined from this count after estimating the total number of nuclei within the root tips.

TABLE 1

CHROMOSOME	A	B	C	D	E	F	G	H
LONG ARM	9.1	11.0	12.2	7.6	8.4	9.1	6.8	3.0
SHORT ARM	7.6	4.6	2.0	6.1	4.6	3.8	4.6	3.0
TOTAL LENGTH	16.7	15.6	14.2	13.7	13.0	12.9	11.4	6.0
SHORT ARM-LONG ARM RATIO	83-100	41.7-100	16.2-100	81-100	54.8-100	41.8-100	67.6-100	100-100

Observations and Discussion

The morphology of the normal crromosome set (2N) of **Allium** sp. was determined. Measurements were made on a number of metaphase chromosomes of each type (A, B, C, D, E, F, G, H). Results of these measurements are shown in Table 1. The lengths of individual chromosomes and the lengths of the chromosome arms in microns as well as the ratio of the short arm to the long arm are shown.

Figure 1 is a camera lucida drawing of a metaphase plate such as was used for measurement and determination of the 8 pairs of homologous chromosomes. The pairs are labeled A, A'; B, B'; C, C'; D, D'; E, E'; F, F'; G, G'; H, H'. A diagram showing the comparative lengths of the individual chromosomes is given in Figure 2.

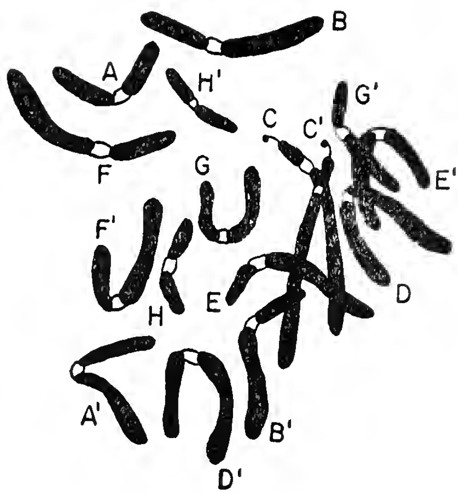

Figure 1

The total length of the normal diploid chromosome set of **Allium** sp. was found to be 102.5 microns.

Young root tips of **Allium** sp. were exposed to various temperatures ranging from 0° C. to 36° C. for periods of 48 hours in order to determine the influence of temperature upon the rate of growth. Temperature intervals of 6° C. were used and these temperatures may be seen along the horizontal axis in Figure 3. Increase in length of the root tips at the various temperatures is represented along the vertical axis in this figure.

By observing the growth curve in Figure 3 it can be seen that maximum increase in length took place at 24° C. At this temperature increase in length over a 48 hour period was 18.9 mm. At temperatures above 24° C. there was a gradual decrease in the rate of growth, with an increase in length of 11.2 mm. at 30° C. for 48 hours and an increase in length of 5.8 mm. at 36° C. for 48 hours. At 0° C. tips showed an increase in length of 0.4 mm. over the 48 hour period. Above 0°C. there was a gradual increase in length until the maximum was reached at 24° C. At 6° C., 12° C., and 18° C., respectively the average increases in length over a 48 hour period were 2.7 mm., 5.0 mm., and 15.7 mm.

Figure 4 shows the percentage of dividing nuclei in root tips exposed to various temperatures for 48 hours. Temperature intervals are given along the horizontal axis whereas the percentages of dividing nuclei are given along the vertical axis.

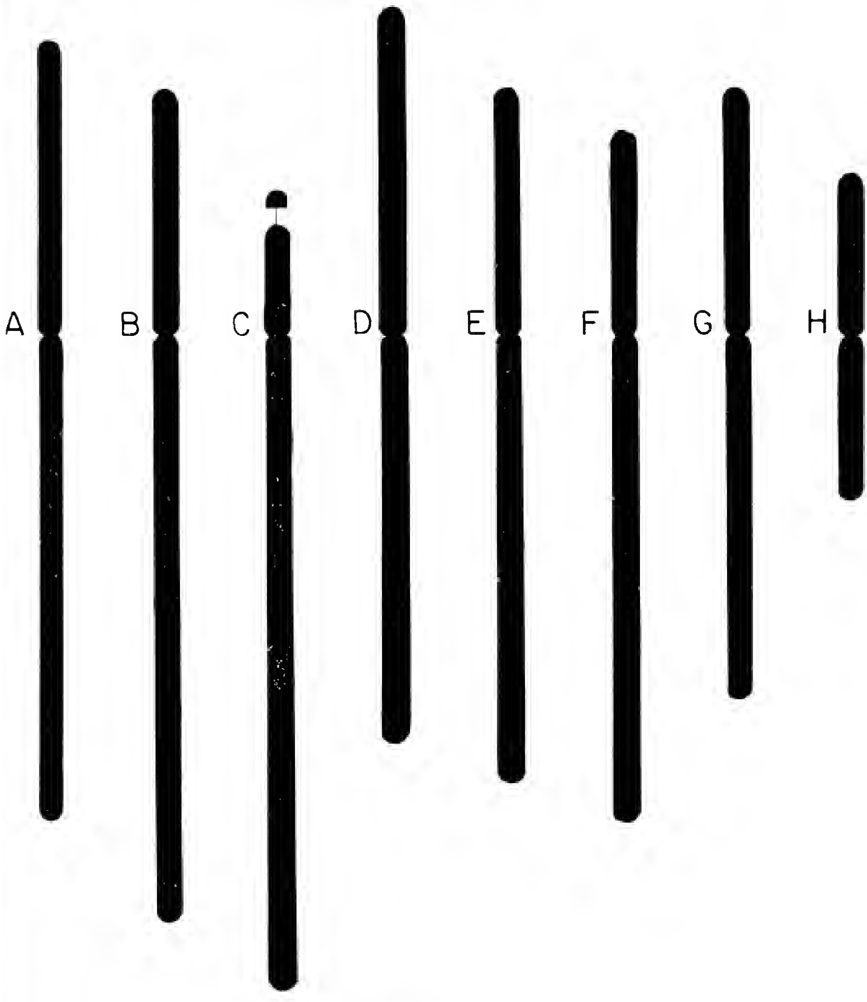

Figure 2

From the curve in Figure 4 it can be observed that the maximum number of dividing nuclei was found at 12° C. At this temperature 9.68% of the nuclei was in some stage of mitosis. At temperatures above 12° C. there was a gradual decrease in the percentage of dividing nuclei until at 36° C. only 2.46% of the total number of nuclei was found to be dividing.

At this point a comparison between the growth curve in Figure 3 and the curve for the rate of mitosis in Figure 4 may be made. Maximum increase in length was observed at 24° C. whereas the maximum number of dividing nuclei was found at 12° C. At 12°

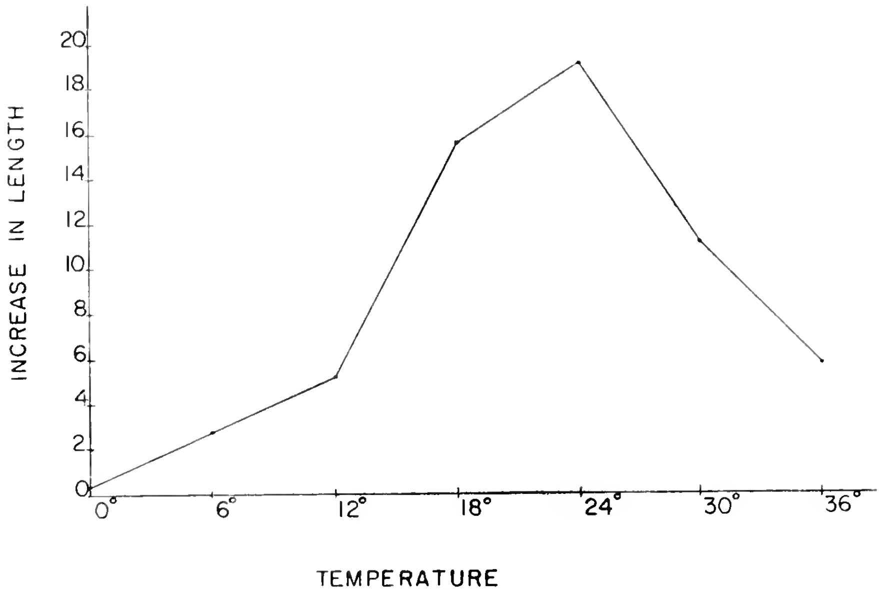

Figure 3

C. increase in length was 5.0 mm. for the 48 hour period as compared with 18.9 mm. at 24° C. At 12° C. 9.68% of the nuclei was observed to be actively dividing as compared with 5.36% at 24° C.

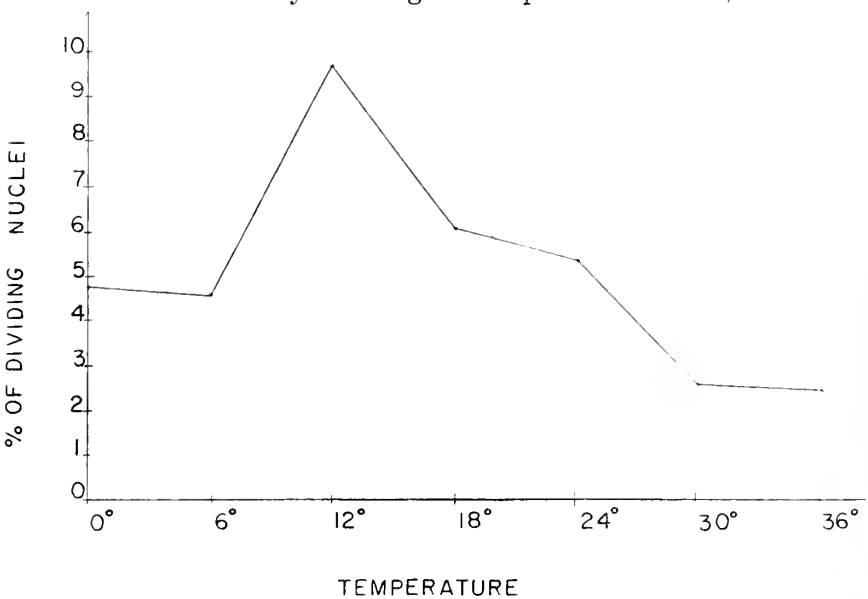

Figure 4

This indicates that the maximum number of dividing nuclei does not appear at the same temperature as does the maximum increase in length.

At temperatures below 12° C. there was a decrease in the percentage of dividing nuclei, with tips exposed to 0° C. showing a slightly higher percentage than did those exposed to 6° C. At 6° C., 4.63% of the nuclei were dividing whereas at 0° C., 4.71% of the nuclei was in some stage of mitosis.

TABLE 2

TEMPERATURE	PROPHASE	METAPHASE	ANAPHASE	TELOPHASE
0°C	71.36%	16.08%	8.46%	4.10%
6°C	67.84%	7.69%	12.32%	12.15%
12°C	66.64%	6.93%	13.35%	13.08%
18°C	65.50%	7.47%	13.58%	13.45%
24°C	72.35%	5.85%	10.67%	11.13%
30°C	65.09%	9.50%	12.91%	12.50%
36°C	71.44%	8.56%	10.44%	9.56%

Perhaps an explanation of the fact that a greater percentage of dividing nuclei was observed at lower temperatures where there was very little increase in length can be found when the percentage of dividing nuclei is broken down into the various stages of mitosis. In Table 2 the percentages of dividing nuclei observed to be in some phase of conventional prophase, metaphase, anaphase, or telophase are shown in the columns headed as such. Between 12° C. and 36° C., the average percentage of dividing nuclei in prophase was approximately 68.2%, the range being from 65.09% at 30° C. to 72.33% at 24° C. Metaphases showed an average of approximately 7.67% anaphases approximately 12.19%, and telophases approxi-

mately 11.98%. At 0° C., the percentage of prophases was slightly higher than the above average, being 71.36%. The percentage of metaphases was abnormally high with an approximate average of 16.08%. The percentage of anaphases was lower, being 8.46%, and the percentage of telophases at 0° C. was only 4.60% as compared with the above average of 11.98%. These figures indicate that the process of mitosis has been slowed down at metaphase. The nuclei seem to enter and complete prophase of mitosis but a temperature of 0° C. is sufficient in some way to inhibit the action of the spindle mechanism. This inhibition of the spindle mechanism appears to continue throughout anaphase accounting for the abnormally low percentages of telophases as well as the low percentages of anaphases. At 6° C., the percentages of prophases, metaphases, anaphases, and telophases compare favorably with the above averages, being respectively 67.84%, 7.69%., 12.32%, and 12.15%. At temperatures above 6° C. little significant variation was seen in the percentages of nuclei in different phases of mitosis, except that at 30° C. the percentage of metaphases was higher than the average, being 9.58% and at 36° C. the percentage of metaphases was some higher, being 8.58%, with lowered anaphase and telophase percentages of 10.43% and 9.55% respectively. This variation does not seem to represent a "slowing down" due to an inhibition of the spindle mechanism because at 30° C. the percentages of anaphases and telophases were normal, being 12.91% and 12.50% respectively and the lowered percentages at 36° C., — 10.43% anaphases and 9.55% telophases —— were not significantly low to suggest an inhibition of the spindle mechanism. At these higher temperatures there does seem to be a slowing down in the number of nuclei that enter prophase.

The mitotic figures themselves appeared normal at all temperatures except at 0° C. where the anaphase chromosomes were not arranged in an orderly fashion being pulled toward the opposite poles, but were spread out suggesting a defective spindle mechanism.

Root tips which had been exposed for a 48 hour period to a temperature of 0° C. were then exposed to 24° C. for 48 hours to determine if the rate of growth and the rate of mitosis would return to normal. After this 48 hour period at 24° C., the approximate increase in length was 18.2 mm., comparing favorably with the 18.9 mm. increase at 24° C. The mitotic rate after the 48 hour recovery period appeared to have returned to normal also. After the recovery period 5.7% of the nuclei were in some stage of mitosis, with 73.1%

in prophase, 5.3% in metaphase, 10.7% in anaphase, and 10.0% in telophase. These figures compare favorably with those for the normal 24° C. exposure for 48 hours, that is, 5.4% of the nuclei dividing with 72.3% in prophase, 5.8% in metaphase, 10.7% in anaphase, and 11.1% in telophase.

SUMMARY

1. The normal chromosome complement (2N) of **Allium** sp. consists of 8 pairs of homologous chromosomes which have a total length of 102.5 microns. The length of individual chromosomes and the short arm - long arm ratio for each was determined.

2. Chromosome C is distinctive in that it has a secondary constriction and a satellite at the end of its short arm.

3. Maximum increase in length of the root tips of **Allium** sp. does not take place at the same temperature at which the greatest percentage of dividing nuclei is found. Maximum increase in length of root tips takes place at 24° C. whereas the maximum number of dividing nuclei is to be found at a temperature of 12° C. At temperatures of 0° C. and 6° C. high percentages of nuclei are found to be dividing, but at these temperatures very little increase in length takes place.

4. There seems to be a "slowing down" of the spindle mechanism at lower temperatures which probably accounts for the high percentage of dividing nuclei at these temperatures with little increase in length of the root tips.

5. Mitotic figures themselves appear to be normal after exposure totemperatures between 6° C. and 36° for 48 hours. At 0° C., the figures are abnormal in that the anaphase chromosomes are not proceeding toward the poles in an orderly manner. This could be due to a defective spindle mechanism.

6. A study on recovery of root tips after an exposure of 48 hours at 0° C. indicates that the nuclei return to normal after exposure to 24° C. for 48 hours, showing that they were only temporarily affected.

7. Temperature effects upon the dividing nuclei are somewhat gradual.

ACKNOWLEDGEMENT

The author wishes to take this opportunity to express her grateful appreciation to Dr. Paul C. Bailey, who suggested this study and under whose direction it was carried on, for his valuable advice, continuous interest, encouragement, and understanding guidance.

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EXPLANATION OF FIGURES

Figure 1. Metaphase plate. Camera lucida drawing of chromosome complement (2N) of **Allium** sp. Approximate magnification X1700.

Figure 2. Diagrammatic analysis of chromosome morphology of **Allium** sp. All figures are drawn to scale at an approximate magnification of X10,000.

Figure 3. Growth curve showing increase in length in millimeters of onion root tips **(Allium** sp.) at indicated temperatures.

Figure 4. Percentage of dividing nuclei in onion root tips **(Allium** sp.) at indicated temperatures.

Table 1. Normal chromosome morphology of **Allium** sp.

Table 2. Percentage of dividing nuclei in various stages of mitosis at indicated temperatures.

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CONTENTS

SOCIAL SCIENCE AND THE AMERICAN FUTURE

JAMES F. DOSTER

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Far-reaching developments in science and technology in recent years have created opportunities for better living and, at the same time, potential for the destruction of civilization. One discovery whets the appetite for more, and international competition for political and economic power brings the dedication of vast material resources to the aid of the scientist. Conjunction of the elements of brain and substance on a huge scale may be expected to bring continued rapid development. But to what end? Who is to direct and control the use of the new tools of science and technology and how can such control be directed to the benefit of man rather than to his destruction. A pressing and terrible question is how to control the use of thermo-nuclear weapons. And the progress of science and technology is likely to present us with additional questions of equal gravity in the future.

The answer is not to be found in some simple formula, in some form of indoctrination, or in some form of blind faith—adjustments which have generally satisfied the needs of mankind in the past, and which yet may serve vital needs. It is not to be found in the pontifications of politicians, the observations of newspapermen, or the off-duty pronouncements of natural scientists. It is not to be found in the ballots of majorities or the protests of minorities.

The one real hope is that social science may provide the answer to the question of how to control and use natural science and technology so that the best interests of mankind will be served and that civilization may endure and develop. Natural science has outpaced social science, which today lags far behind. Religion is a vital and necessary force, but we see ministers of religion, often dedicated men, readily become the dupes of interests finding them useful—for lack of knowledge of social science. Let religion provide the principles, but effectively applying them to complex human society requires knowledge of government, economics, sociology, psychology, and history. These branches of learning are today poorly developed, and the best of what has been learned and developed on the frontiers of research is not being effectivly applied or passed on to students in our colleges and high schools.

If social science is to close the gap by which it lags behind nat-

ural science, prodigious efforts will be required to learn the principles which govern human society. It is urgent that these efforts be begun without delay. The amount of lost motion to be expected in the effort is large. In the army of a country long protected from real danger, the command will not be found to be in the most capable hands at the start of a war. So in social science research, those likely to be called initially to lead a vigorous search for principles will be newspaper men, entertainers, politicians, textbook writers, and persons well-known to the public and better suited to adapting their product to a market than to discovering new knowledge. The chances are that extensive funds suddenly made available for social science research would mostly go to waste, but some of the apparent weeds, accidentally fertilized, might bear unexpected fruit. Such has been the history of discovery. In the world's desperate need for haste, some waste must be accepted.

What are the potentialities of social science? Can it ever discover principles to compare with the established principles of natural science? The "laws" of natural science operate predictably only so long as their parameters are constants. "Laws" of economics or other social science branches should be discoverable, laws which can meet the same standard. Hypotheses which stand up under tests have been the working tools of the natural scientist. Can the social scientist not use the same approach? In my judgment the answer is yes, but the research to test the hypotheses must be persistent and intense—a kind of research generally beyond the economic resources of the social scientist and unappreciated by those who might give material support to his efforts. At present there is very little to encourage exhaustive analytical research in the social sciences in the United States and progress is at a snail's pace.

My own field of history is often classified as belonging to the humanities, rather than the social sciences, and that is where the work of many of its practitioners belongs. When I was a graduate student at the University of Chicago in the 1930's, history students registered in either the Division of the Humanities or the Division of the Social Sciences, according to their choice, although the work was the same. Most of the students chose the latter division, thus indicating the conception of history which appealed to them; yet, in practice, the product of their research was nearly all descriptive rather than anlytical. In the first place, analytical research was difficult; in the second, it was economically unrewarding, sometimes disastrous, to the person trying it. I have known various good analysts, but they have had a hard row to hoe. The potentialities are

great, but conditions in the profession are today unfavorable to exhaustive analyses of the controlling influences in past human affairs.

In the field of economics, there has been rapid development in recent years, with all the characteristics of hasty thinking. Thirty years ago serious economists were still explaining business cycles by reference to sunspots; today serious economists think they know how to adjust the nation's affairs to assure permanent prosperity—from voodoo economics to utopia in a generation! Actually not all were so naive thirty years ago nor are all so over-presumptious now; yet the development has the characteristics of over-rapid growth, and there continues a strong tendency for economic theory to be determined by the interests of the respective economists or their employers. Great further developments are possible, but the purity of academic detachment needs cultivation.

In the field of sociology we find a great deal of description, which is valuable, but real analytical work moves at a slow pace. The relation between economic forces and social behavior and institutions has been observed and commented on but little analyzed. The sociologists have been impeded by a professional jargon, in which an observed but unanalyzed factor is given a name, by which it is referred to with affected familiarity, deceiving not only the layman but other sociologists and finally the speaker or writer himself. One such term can be defined in terms of others of like uncertainty until a language is developed without a sound grounding in precisely defined terminology. The sociologists compound their difficulties by borrowing terms from the psychologists, who are often equally unprecise. (Psychology by strict definition is not a "social" science, but the social scientists must rely heavily upon it.) Sociological writings are full of generalizations and rules of thumb to explain social behavior, but theory of social behavior is little developed. A theory is a discovered principle or set of principles that governs in a manner that has been analyzed and explained and to which, within described and explained limits, there are no exceptions. Analysis of social behavior on a case basis is a familiar sociological technique, and a good one, but analyses are usually superficial. A good social researcher needs to be a person of very broad knowledge and personal experience and needs to know well the related social sciences. Case research in representative cases needs to be exhaustively pursued, perhaps by many persons of varying skills and knowledge working successively on the same case, the purpose being to find the controlling forces in social behavior. Un-

der capable direction and with sufficiently persistent effort, such research ought to unlock secrets of human society, and, perhaps some day make possible the creation of real social theory, on the basis of which public policy could safely be formulated. Sociology offers promise for the future, but current progress in research seems far too slow and faltering to meet urgent needs.

The social sciences stand together as a group and the development of one depends upon the development of the others. The good historian excels in time and sequence perspective. Trained in one or more of the other social sciences, he can sometimes do some forms of research in economics or sociology or government better than a specialist in one of those fields, and, preferably in collaboration with such a specialist, can contribute greatly to the development of the related field. Standards of criticism in the historical field, which is older than the others, are well developed and need to be applied as far as applicable to the newer disciplines, where they can help to reform sloppy mental habits. (The historians' performance does measure up to their standards!) Developments already made in the field of economics can revolutionize history, political science, and sociology when effectively applied. The psychologists and sociologists can greatly help all the others and have done so. At least some knowledge of political science is essential to the practitioners in the other fields.

The study of government has been actively pursued for many years now, until it has become a branch of learning, a social science. The increasing size, scope, complexity of government calls for a working machine that is both complex and efficient and that serves effectively the general public interest. The growing detail of the regulation of the life of the people and the new function of guaranteeing their social welfare by government make effectively functioning public institutions vital to us all. Can government give people the guarantees they demand without taking away their liberty? Only a well-organized and well-run government can do so. Perhaps the political scientists can tell us how it can be done—not out of a meaningless imagination, for this is not an imaginary world, but out of thorough and persistent and constructive investigation. First they must learn the controlling influences in government and how they work. On this they need better help from the historians and economists than they have been getting. A political scientist needs as broad and practical personal experience as possible and as much training as he can get in the related social sciences, for he should be a man of sound judgment.

Up to now I have discussed the development of the social sciences to serve compelling world needs, to close the widening gap between social and natural science, a gap which, at best, seems sure to get much wider before it can be narrowed, a gap representing great danger for world civilization. Not only is every possible stimulus and encouragement needed to develop increased knowedge of social science, but also a great effort is needed to impart to the educable youth of America through the schools the best knowledge we now have.

In the recent past there has been much said about the lack of natural science education in our high schools, and I controvert none of it. What has been missed is that social science education in preparatory schools is no better. Few high school teachers are qualified to teach social sciences (I tip my hat to the honorable exceptions), and few principals or superintendents are prepared to judge soundly the work of the teachers. Whatever college degrees teachers and administrators may have, they do not get them (with rare exceptions) in the social sciences.

Freshmen entering college commonly have learned but not digested a little catechism about democracy, but do not know the essential machinery of the government of this country, although they have sat through courses in "civics," "social studies," and "American history." They have rarely had any semblance of introduction to economics or sociology, to say nothing of psychology. Many are unable to comprehend the language of college textbooks and are terrified at the thought of an essay examination. A question requiring an answer of more than two lines is likely to bring paralysis of the pen fingers. An oral question to which a set answer has not been previously supplied brings a silent look of wonderment. College freshmen today are intellectual softies, generally deficient in mental discipline of the most fundamental kind, and for the most part their training in social science has been little better than a farce.

If social science is to play a role in the American future, a role that seems vital to the salvation and development of civilization, if social science is to keep pace with natural science and march in step with it, intelligent and well-directed development in many directions must soon be pushed with vigor. There is nothing democratic about intellectual development—it begins at the top and filters down. The urgency of reform of the schools with respect to the natural sciences is well-known, but its urgency with respect to the social sciences is equally great.

HELIOTROPISM IN SIDA RHOMBIFOLIA

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Sida rhombifolia L., belonging to the Malvacaae, was originally described from India more than 200 years ago, and is now rather widely distributed in tropical countries, and has been known for over 100 years as a weed of roadsides, barnyards, gardens, etc., in the southeastern states, mainly in the coastal plain. In Georgia and Florida, if not elsewhere, it is known as "teaweed," but the reason for this is not obvious. It is not yet known in the area covered by northeastern manuals, where botanists are most numerous, and consequently it has not received much attention from writers of nature books.

It differs from other species of the genus that grow in North America, but resembles some in various other families, in "going to sleep" at night, by turning its leaves, at least those on the younger erect stems, in summer, vertically upward, so that only their lower surfaces are then exposed. I had known the plant in Georgia for over sixty years, but did not notice its sleep movements until several years later, in Alabama. I then thought I had discovered a new phenomenon, that ought to be put on record; and in 1907 or thereabouts I sent a short note on the subject to a botanical magazine. The editor accepted it, but before it was to go to the printers I discovered that Charles Darwin had observed the same thing about the time I was born. So I recalled my manuscript, and gave the matter no further thought, except to mention the sleep movements of that species in my bulletin on Alabama weeds (1944).

Not until the summer of 1958, on the University campus and elsewhere in Tuscaloosa, did I notice that the leaves, or most of them, not only turn upward at night, but change position during the day, so as to face the sun as nearly as possible both morning and evening. I then turned again to Darwin's book, "The power of movement in plants," prepared with the assistance of his son Francis, and published in 1880, and various later editions. That book discusses the movements of leaves and various other parts of plants, some apparently spontaneous and some in response to various stimuli, in many species of plants in different parts of the world, but more of them in the Leguminosae than in any other family. Most of the material that Darwin worked with seems to have been potted

plants from the great Kew botanical gardens, so that they did not necessarily behave the same as they would have done in the wild, fully exposed to the sun and weather.

Darwin's observations on *Sida rhombifolia* cover about two pages of the book. He even traced the movements of a leaf-tip during a period of about two days, in late May, but had only a young plant, 9½ inches tall, and that under a skylight. And he did not notice any difference between the morning and afternoon positions, as he might perhaps have done if he had had an older plant, later in the season, and fully exposed to the sun.

Early in September, 1958, I found a plant about waist-high and well-situated for photographing on the University campus, and took two pictures of it in the morning and two in the afternoon. It was in an open grassy place, but protected from mowing by a guy-wire. (And I was just in time, for I found it chopped down the next day.) I took pictures from different distances both times, but only the close-ups, taken from a distance of 18 inches, show the leaf positions plainly enough to be used here. Comparing these pictures, it might appear as if some of the branches had changed position in six

Sida rhombifolia on University campus, Tuscaloosa, Sept. 9, 1958. Camera pointing north. Showing morning and evening positions of leaves on same plant. Left, 8:44 a.m., right, 3:13 p.m.

hours. But they are pretty stiff, almost woody late in the season, and that appearance was caused by the fact that those branches were not in the same plane with the main stem, and I did not have the camera in exactly the same position each time. (In such an exposed place it would have been impractical to leave the camera or even the tripod in place all day.)

Although I have not watched this plant early in the morning, or any length of time later in the day, I assume that the leaves on the east side would descend rapidly from their night position in the morning, and turn up slowly through the day, while those on the west side would descend slowly in the morning and turn up rapidly toward evening; and north and south leaves would behave still differently. A moving picture of such a plant, with say one exposure a minute from sunrise to sunset of a cloudless day, should be very interesting. Incidentally, I have been accustomed to seeing the flowers of this species open only in the morning, but longer on cloudy than on sunny days.

It is probably well known that some other plants whose flowers open only in the morning usually face the sun in doing so. A good example of this is *Sitilias Caroliniana* (Cichoriaceae), a common southern weed of unknown origin. In the latitude of Tuscaloosa it blooms mostly in May, and its flowers usually close about 9 a.m., or later on cloudy days. But in weedy prairies a little southwest of Eutaw I have found a form of it with shorter and simpler stems quite abundant, with flower-heads still wide open in midday, and then erect or nearly so.

In Okefinokee Swamp in August, 1902, I noticed large colonies of a common fern, *Anchistea Virginica*, with fronds nearly all facing east in early morning.* But although I have seen the same species many times since, in other places, to this day I have never thought to follow it up when I had a chance, to see it they turn with the sun and face west in the afternoon.

*See Torreya, 2:157. Oct. 1902.

THE SOCIOLOGIST, SOCIAL CHANGE, AND VALUE THEORY

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As can readily be appreciated, the title of this paper refers to an extensive and complex subject area. In this brief paper, let me hasten to suggest, only a prolegomenon to an appreciably longer statement more in keeping with the character of the subject area can be attempted. I believe the subject area to be sufficiently unexplored, however, so that a prefatory foray can still be productive.

Turning to our task, one problem posed for the sociologist when confronted by the fact of social change is the place of value in human living. William Graham Sumner long ago recognized this when he suggested that the mores can make anything right. If we look over the career of the sociologist, we perceive a figure recurrently bothered by the problem of human values. As Gunnar Myrdal wrote a few years ago: "... I must now confess that I have not read any major work, nor written any myself, which fully satisfies me as really meeting the demands of how properly to deal with facts and valuations in social science."[1] It would appear to be the case that for the sociologist today, regarding value theory and its relations to his own preoccupations, he confronts essentially the same sitation that Myrdal confronted five years ago. It is not the case that value is a neglected topic in our discipline—indeed, it comes evermore to the fore in our thoughts, our discussions, our writings; nevertheless, it remains a relatively little explored area, if we mean by this a fundamental probing towards a sociological theory of value.

Consider, if you will, the value problem involved in Margaret Mead's recent proposal that we establish "Chairs of the Future" or academic positions wherein the incumbents

> . . . will devote themselves, with all the necessary scholarship and attention, to developing science to the full extent of its possibilities for the future, and who will devote themselves as faithfully to the fine detail of what man might very well—in the light of all our knowledge—be as any classicist or medievalist devotes himself to the texts of Pindar and Horace or to the thought of St. Thomas Aquinas.[2]

This is not, of course, a new proposal nor a new perspective on the role of the scientist.

In sociology, one readily recalls Auguste Comte's sociologist-

priesthood as an instance of the scientific figure whose principal preoccupation was to be the application of accumulating knowledge for the reconstruction and guidance of society. In America, later, Lester F. Ward took a somewhat comparable position as to the responsibilities of the sociologist with his concept of "social telesis" which was, in effect, the intelligent directing of social change. For a more recent and emphatic contribution we have Robert S. Lynd's *Knowledge for What?*, which similarly set forth an interventionist position for the social scientist.

Common to all of these thinkers and Margaret Mead is the firmness of their belief in the worthwhileness of scientific knowledge for the guidance of social change and development. Readily we ask, today, as have others in the past: Yes, but in which direction? Thus, when Margaret Mead suggests "Chairs of the Future," we confront at once the perplexing and persisting problem that when it comes to the application of our knowledge for the guidance of social change or cultural development, in the service of which values shall our scientist devote his knowledgeable efforts?

It might be argued, however, that that is precisely the task of the scientist— let us call him the "futurist" — who is concerned with man's future: to isolate the values which are to be pursued in man's social existence. Our futurist, it might be claimed, with his command of the various scientific disciplines, is the one most capable of diligently pursuing the objective (in Margaret Mead's terms) of determining "what man might very well . . . be" or to set forth (as she describes them) the "vivid utopias" for which we should strive.

But, here, we run into a major problem. To cite an instance, in Margaret Mead's field of anthropology, in particular, there has existed rather prominently a line of thought — emanating from a growing recognition of our pervasive ethnocentrism as we had increased opportunity to live amidst and to become acquainted with other peoples and their cultures — which emphasized the worthwhileness of alternative cultural orientations or conglomerate value structures and which has come to be known as cultural relativism. As has been rightly claimed, cultural relativism is "surreptitiously moral."[3] The cultural relativist denies the utility of knowledge as a foundation for the critical appraisal of alternative cultural value systems. While many have contended that the scientist has no role in making a decision among different cultural value sets, yet this is the nature of Margaret Mead's proposal.

Here, we have, then, a familiar dispute in the area of human

values: What is the role of science in the value area? In sociology, Max Weber held that the scientist and his knowledge could be of service in the value area, but the scientist did not exist for the purpose of making value-judgments. From his stand, this was beyond the purview of science. As he wrote:

> Tolstoi has given the simplest answer, with the words: "Science is meaningless because it gives no answer to our question, the only question important for us: 'What shall we do and how shall we live'?" That science does not give an answer to this is indisputable.[4]

In opposition to Weber's position would be a work such as the aforementioned book of Lynd's, *Knowledge for What?*; however Lynd tends to bulldoze aside the value-neutralist's predicament and protestations with a blade fashioned from Thomas' four wishes propelled by his own incensement over what he considers to be the neglected needs of the times.[5] A more carefully stated position which contradicts the one taken by Weber would be that of Mortimer R. Kadish. Kadish, in discussing what he terms the ". . . most important and bemusing of all problems, the problem of what is to be done," provides an answer to the argument that science has no role in making ultimate value decisions when he writes:

> . . . for decision analysis, particular choices stand in relation to the "normative" force of ultimate values under which they are subsumed roughly as experiments stand to the hypotheses with respect to which they are experimental. For the hard data of value are concrete choices; and the legitimacy of values ultimately stems from the failure or success they bring in meeting choice conditions.[6]

Where Weber argued that science could not be helpful in making final decisions in the ultimate value area — he saw alternative ultimate value positions as being in irreconcilable conflict, Kadish proposes a less rigid position, one where the "reasonableness" of a major value orientation is dependent upon its "usefulness" in the choice situations with which it has been confronted.[7]

Essentially, these two basic and contradictory stands on the role of science in the value area have haunted sociologists — and one should say other scientists, as well — down to the present. Elsewhere,[8] I have documented these two perspectives among American sociologists during the Depression Years, when they were self-consciously asking themselves as to the role of the sociologist in a period of community crisis and doubt. That the controversy over value in sociology is a lengthy one, even at this early date in the American situation, was documented by L. L. Bernard's remark, in 1935, that he and Charles Ellwood up to that time had been arguing the issue for twenty-five years.[9]

This division in sociology is still with us. Indeed, it exists in all science, though it may seldom be perceived, acknowledged, or discussed. In sociology this division can be readily attested by a cursory perusal of our introductory texts and their handling of the value problem, or by a careful scrutiny of some of our more involved theoretical productions relating to human behavior.[10]

The importance of the persistence of controversy over value in science should not be adjudged from a perspective which assesses this disputation as a temporary inconvience. It would be more helpful to look at this disputation from the point of view of what the meaning would be for the particular science involved — here, immediately in mind, is my own discipline of sociology — were one of the positions in question be deemed an acceptable or preferable position. Since the value-neutrality position for the scientist is the most popular one today, we might consider the alternative and ask: what would be the meaning for sociology were we to conclude that science does have a crucial role in the area of value determination? What would be some of the implications for sociology were we to presume that it was one of our primary functions to develop knowledge for the intelligent directing of social and cultural change? That is, what if it were our task to not alone determine the means whereby preferred basic cultural values were to be secured, but also to develop knowledge for the making of fundamental decisions among alternative cultural value orientations, as well as to actively participate in the determining of which, at any given point of time and place, could be considered as the preferable basic cultural value position?

Before hands are raised in horror over the radical departure from tradition or the mind closed by timidity when confronted by what is admittedly a task of most formidable dimensions when fully perceived, there is need to consider a few points relating to the alternative to this cultural interventionist role for the sociologist, and then to try to entertain the perspective of active interventionism long enough to see how it is related to some fragments of ideas and suggestive influences already close at hand. The alternative to the cultural interventionist role for the scientist is seldom pursued systematically, but one important consideration has to do with the fate and fortune of science itself. Science, after all, in our culture, at worst, is a tolerated type of behavior and, at best, a not too well understood and not too handsomely supported phase of community life. The Western scientist, and particularly the social scientist, finds that at times he is an unwelcome guest, parti-

cularly when he attempts to objectively study some of the more sensitive areas of collective existence. One does not have to go far to perceive the inconvenient and persecuted intellect or, what is just as shameful and dangerous, the silenced intellect. At times, it is perfectly apparent, we would just as soon not see too clearly, if at all, how or why we behave as we do, or even what our physical world is like. And this willful blindness is as true of the scientist, at times, as it is true of others in our society. The story of the development of science informs us that even the biological and physical scientist has not always been appreciative of the findings made or the developments taking place in his own field. Social tolerance and half-hearted support of science may give way — even in our so-called enlightened Western society — to outright opposition and complete withdrawal of support, which means the eventual strangulation of the scientific enterprise and spirit. This fear of selective support of and selective antagonism toward science in our day, especially by modern governments, is not wholly without foundation. It has been amply demonstrated by developments in Nazi Germany and the Soviet Union. Just a few years ago, our Congress refused to support the social sciences while supporting the biological and physical sciences; we even had the ridiculous spectacle of scientists protesting the support of the sciences concerned with human behavior. The scientist's refusal to be concerned with value decision may lead to his own extinction.

Now, presuming the interventionist role for the sociologist, what might this mean for his discipline? First, and foremost, would be the requirement to detail this different approach to value, to specify the outlines of how the sociologist might work towards a theory regarding human values. Values, from this view, whether great or small, ultimate or intermediate or primitive or howsoever they may be designated, are not to be regarded as sacrosanct just because they are found, held, or existent in the human community. It would seem probable that one lesson to be discovered on the rubbish heap of discarded human values would be that when one stops to consider the values human beings have fought and suffered and died for only to have these selfsame values lost in history as mistakes, or worse, as ridiculous, as insignificant and of no importance, it should give us pause to wonder about the bases of human value allegiances. Interestingly enough, there seems to be no lack of agreement that human values exist, no lack of interest in surveying the range of human values held, no hesitancy to ascribe importance to value for behavior observed, but there is

a curious lack of interest in the genesis of value, in the grounds for value held, in the bases for the weighing of one value with other possible values. One might easily hazard the guess that this displayed lack of interest in the genesis of, grounds for, and weighing of values results from the descriptive emphasis in our discipline, but there is, here, a neglect of even the descriptive approach to sociology for one might ask for a description of the process whereby new value orientations appear in the human community; or a description of the grounds, or lack thereof, bulwarking values held in social living; or a description of processes, or lack thereof, whereby human beings weigh value alternatives. Is the lack of interest in these approaches to value occasioned by the inconveniences resulting from such research? Such a question is but speculative at this time, however this is an area in need of investigation. Some information is presently available in the sociology of knowledge field. More important, here, however, is the pointing to the need for fundamental value study and theoretical value formulation on the part of the sociologist. The intellectual power of the sociological perspective has only been haphazardly and incompletely applied in the value area.

A second point to be stressed for the sociologist who perceives his role and discipline from the interventionist perspective is an appreciation of the enormity of this task of attempting to responsibly control socio-cultural change. A major pitfall directly in his path might be characterized by that bit of folk wisdom as to fools rushing in where angels fear to tread. One of the most perplexing problems to immediately confront the interventionist sociologist is the need for a deeper understanding of his own work. Some important leads of earlier thinkers are available to lend guidance. Some of them are being explored today, albeit somewhat sporadically. These very explorations may strike constructively, or destructively, at the interventionist position. Thus Emile Durkheim's "collective representations," or Znaniecki's "cultural reality," or George Herbert Mead's "significant symbol" of an earlier day find reflection in the interest being expressed in the symbolic interactionist approach to human behavior or in the pursuit of Benjamin Lee Whorf's work on the importance of language systems for the reality confronting the human being. Such interests, with results achieved to date, are of great significance for the interventionist position.

Karl Mannheim, that assiduous gardener in the sociology of

knowledge plot, recognized the problem of relativism as indicated in his precaution regarding social analysis:

> The main difficulty in the discovery of new *principia media* is that we have to search for them among objects which are still closely bound up with all our practical concerns, and further, because the standpoint from which we try to observe them is in itself not entirely stable. We ourselves stand in the midst of the development and interplay of these active forces.[11]

Niels Bohr has suggested a possible application of his complementarity principle in the cultural area and which indicates for us some of the perplexities we will be confronting in attempting an interventionist science:

> Using the word much as it is used, in atomic physics, to characterize the relationship between experiences obtained by different experimental arrangements and visualizable only by mutually exclusive ideas, we may truly say that different human cultures are complementary to each other.[12]

As we progress with our adventures in relatively unexplored areas of human thinking, we can anticipate there will be many great inconveniences for traditional thoughtways. At this stage it makes the head ache and rock to consider some of the complexities involved with responsible interventionist thought. This suggestion of a sociology oriented towards intervening in the social change area is not proposing anything in the way of a simplification of the sociologist's task.

And, now, finally let us return to Margaret Mead's "vivid utopias" proposal. The sociologist, if he is an interventionist, has a vital role to play in the creation of more vivid utopias for man. Before the sociologist can perform in this role, however, there is need for him to confront and refute the value neutralist's position, which is taken by very many social scientists today. To do this, he will have to deal with the value problem, and this he can only do by a much greater display of interest in value theory. Should the theory of value which emerges be oriented toward the empirical, and away from the a priori and intuitive, then I believe the sociologist will find himself in a position to legitimize an interventionist role for himself. Then, possibly, he can set about helping in the area of socio-cultural change to the effect of dispelling fears of an age of nuclear destruction and assist in ushering in the adventures of a space age.

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COLLEGE EDUCATION AND STUDENT ATTITUDES ON LABOR RELATIONS

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What influence does education have upon the attitudes of young people toward labor-management relations? What opinions do college students hold in this vital area? Are there differences in the attitudes of Education students and of Business Administration students on industrial relations issues? Do the opinions of college Juniors and Seniors in this field differ from those of Freshmen and Sophomores? This study presents tentative answers to these questions based upon the response of representative students in one of the major colleges in the Southeast.

Source of Data

Data for the study have been drawn from a questionnaire survey of 300 of the approximately 8,000 students enrolled in the Alabama Polytechnic Institute (now Auburn University) at Auburn, Alabama, during the winter quarter of 1956. The questionnaire was administered in required courses in which students from each of the college's ten schools were present. From the 450 forms completed, a stratified sample of 300 was drawn by random sampling techniques so that each school and college class was proportionately represented. The final sample included, along with others, 49 education students, 27 business administration students, 157 freshmen and sophomores and 120 juniors and seniors.[1]

The questionnaire used asked the students to express their opinions on 26 issues in the realm of labor-management relations. Of these questions, 16 have been selected for examination in this paper.[2] To highlight the differences in attitudes, only the answers indicating definite preferences are presented.

Auburn Students Are Sympathetic To Management

Of all the 300 students surveyed, a slight majority of those expressing a preference for either labor or management state that they are sympathetic with management, as is shown in Table 1. A majority of the students are also optimistic about the future of labor-management relations, for three-fourths of those with opin-

Table 1 **Attitudes of Auburn Students On Selected Labor-Management Issues**

	Course Of Study			Year In College	
	All Students	Education	Bus. Adm.	Freshman-Sophomore	Junior-Senior
	(300)	(49)	(27)	(157)	(120)
1. Sympathies lie with:	%	%	%	%	%
Labor	48 *	71 **	33	64 ***	30
Management	52	29	67	36	70
2. Feel that interests of management and labor are:					
Fundamentally in agreement, some differences	74	71	77	75	74
Fundamentally different, some agreement	26	29	23	25	26

* Difference between answers of All students and of Education students significant at the 5 per cent level.

** Difference between answers of Education and Business Administration students significant at the 5 per cent level.

*** Difference between answers of Freshmen and Sophomores and Juniors and Seniors significant at the 5 per cent level.

ions believe that the interests of management and of labor are fundamentally in agreement, with only some differences.

Do a majority of the students actually side with management on concrete issues? The data in Table 2 give a partial answer. The possible responses to each of the 14 questions dealing with specific labor practices which are given in this table have been evaluated by the authors as indicating sympathy with either labor or management and accordingly marked with an "L" or an "M." Measured against this standard, the answers given by a majority of the 300 students who express an opinion (referred to hereafter as "All students") are favorable to management in 11 of the 14 instances. Thus, a majority of all students report that they would prefer to work in a non-union plant, oppose the union shop, feel that unions should not continue to grow in political power, would have voted for the Taft-Hartley Act, believe that labor is more responsible than management for rising prices, oppose sympathy strikes and picket lines, favor injunctions in labor disputes, blame labor more than management for most strikes, believe that management should have the sole right to hire, and would give efficiency greater weight than seniority in layoffs.

On the other hand, a majority of All students believe that management should encourage workers to join unions, feel that unions should continue to grow in bargaining power and give labor major credit for taking the initiative in securing important benefits for the workers.

Education Students vs. All Students

Nearly three-fourths of the Education students with preferences picture themselves as more sympathetic to labor than to management. In contrast, a majority of All students report that they favor management. Despite the differences between the expressed sympathies of the two groups—a difference which is statistically significant at the five per cent level of confidence[3]—a majority of Education students take the same stand as the majority of All students on each of the 14 questions in Table 2. They favor management on the same 11 issues. They favor labor on the same 3 issues. On two of the questions, however, the answers of the Education students are significantly *less* favorable to labor (at the 10 per cent level of confidence) than are the answers of All students. Specifically, the Education students are much more opposed to picketing and much less inlined to give labor major credit for assuming the initiative in securing benefits for workers, than are All

Table 2 **Attitudes Of Auburn Students On Selected Labor-Management Issues**

	Answer "Favors"	COURSE OF STUDY All Students	Education	Business Adm.	YEAR IN COLLEGE Freshman-Sophomore	Junior-Senior
		(300)	(49)	(27)	(157)	(120)
Industrial Relations Philosophy		%	%	%	%	%
1. Prefer to work in a:						
Unionized plant	L	49	46	58	55	(2) 41
Non-union plant	M	51	54	42	45	59
2. Management should:						
Encourage workers to join unions	L	57	62	50	77	(2) 29
Discourage workers from joining unions	M	43	38	50	23	71
3. If a majority of the workers belong, the others should be required to join the plant union:						
Yes	L	19	21	23	23	(5) 15
No	M	81	79	77	77	85
4. Union should continue to grow in bargaining power						
Yes	L	58	70	64	65	(5) 53
No	M	42	30	36	35	47
5. Unions should continue to grow in political power:						
Yes	L	14	23	23	11	15
No	M	86	77	77	89	85
6. Would have voted for the Taft-Hartley Act:						
Yes	M	76	63	79	74	79
No	L	24	37	21	26	21
Wage Policies						
7. Initiative in providing worker benefits (high wages, shorter hours, bonus plans, pensions) usually taken by:						
Management	M	23	(3) 37	14	26	22
Labor	L	77	63	86	74	78

Table 2 (continued)

	Answer "Favors"	COURSE OF STUDY All Students		Education		Business Adm.		YEAR IN COLLEGE Freshman-Sophomore		Junior-Senior
8. Most instrumental in causing rising prices:										
Management	L	15		22	(1)	0	(4)	15		14
Labor	M	85		78		100		85		86
Dispute Practices										
9. Truck drivers should support striking local unions in manufacturing plants with sympathy strikes:										
Yes	L	11		12		15		11		11
No	M	89		88		85		89		89
10. Unions should be permitted to picket during strikes:										
Yes	L	45	(3)	30	(1)	58		51	(2)	39
No	M	55		70		42		49		61
11. Injunctions should be used in local disputes to require workers to return to work:										
Yes	M	73		66	(1)	88	(4)	77		71
No	L	27		34		12		23		29
12. Which group is responsible for most strikes?										
Management	L	21		18		19		28	(2)	12
Labor	M	79		82		81		72		88
Management Prerogatives										
13. Who should have the right to hire?										
Management	M	86		79		93		81	(5)	89
Labor, or labor and management jointly	L	14		21		7		19		11
14. Which should be weighed more heavily in layoffs?										
Efficiency	M	83		86		75		84		84
Seniority	L	17		14		25		16		16

(1) Difference between answers of Education and Business students significant at the 5 per cent level.
(2) Difference between answers of Freshmen and Sophomores and Juniors and Seniors significant at the 5 per cent level.
(3) Difference between the answers of All students and Education students significant at the 10 per cent level.
(4) Difference between the answers of Business students and All students significant at the 10 per cent level.
(5) Difference between the answers of Freshmen and Sophomores and of Juniors and Seniors significant at the 10 per cent level.

students. Thus, on concrete issues, Education students do not appear to be more sympathetic to labor than do All students, despite their expression of preference for labor.

Education Students vs. Business Administration Students

Two-thirds of the Business Administration students with preferences report that they are more sympathetic to management than to labor. Consistent with this self-analysis, a majority of these students express management views on 9 of the 14 issues presented in Table 2. On a tenth question, management encouragement of union membership, they are evenly divided. On four issues, however, a majority of the Business students assume positions usually attributed to labor. Specifically, a majority would prefer to work in a union plant rather than a non-union one; they believe that labor usually takes the initiative in obtaining improved benefits for workers; they want unions to continue to grow in bargaining power, and they would sanction the use of picket lines to strengthen that bargaining power.

The most striking difference in the attitudes of the Education and Business students lies in their expressed sympathies. Two-thirds of the Education students report that they are sympathetic to labor. Two-thirds of the Business students say they favor management. This difference is statistically significant at the five per cent level. Significant differences are also found in the answers to three of the questions in Table 2. A majority of the Business students would allow unions to picket to make their strikes effective, but a majority of the Education students would not. On the other hand, the Business students are more ready to blame labor for rising prices and would be more willing to use injunctions against labor in local disputes than would Education students.

On other important issues, the thinking of the two groups of students is quite similar. A majority of both groups oppose the union shop, feel that labor should not continue to grow in political power, would have voted for the Taft-Hartley Act, oppose sympathy strikes, blame labor for most strikes, feel that management should retain sole right to hire, and would place greater emphasis on efficiency than upon seniority in making layoffs. On the other hand, a majority of both groups feel that unions should continue to grow in bargaining power and believe that labor usually takes the initiative in providing workers with benefits.

According to their answers, the Business students are somewhat more optimistic than are the Education students about the

fundamental agreement between the objectives of labor and management. This difference, however, is not significant (see Table 1, question 2).

Business Administration Students vs. All Students

Only a brief glance need be given the comparison of Business students with All students. A greater majority of the Business students than of All students report they are sympathetic with management rather than with labor. Yet a small majority of the Business students would prefer to work in union plants rather than in unorganized plants and would sanction the use of picket lines, whereas a small majority of All students hold opposite views. On the other hand, a majority of All students would have management encourage union membership, whereas Business students are evenly divided on this issue.

The greatest differences in the answers given by these two groups, are found on the two following issues, and only at the 10 per cent level of confidence. As can be seen in Table 2, more of the Business students than of All students blame labor for rising prices and are ready to use injunctions in local labor disputes.

Freshmen and Sophomores vs. Juniors and Seniors

Some light may be shed on the influence of college training upon student attitudes in the field of labor-management relations by a comparison of the answers given by Freshmen and Sophomores with those given by Juniors and Seniors. The differences observed may be due to such factors as differential drop-out rates among those sympathetic to labor or to management as well as to the impact of greater maturity and increased knowledge acquired during college years. Nevertheless, the contrasts should be indicative.

Two-thirds of the Freshmen and Sophomores with preferences state that they are more sympathetic to labor than to management. Yet on 9 of the 14 questions in Table 2, the views reported by a majority coincide with those usually attributed to management. On five issues, however, a majority take positions favorable to labor. These students prefer a union plant to a non-union plant. They would have management encourage union membership. They want unions to continue to grow in bargaining strength. They would give unions the right to picket, and they credit labor with usually taking the initiative to secure increased benefits for workers.

In sharp contrast with the beginning students, more than two-thirds of the Juniors and Seniors with preferences say they favor

management. And their answers to 12 of the 14 questions in Table 2 substantiate this reply. Only on the questions relating to growth in union bargaining power and initiative in providing benefits, do a majority of the advanced students state views favorable to labor.

Even though both groups of students favor management on most of the issues examined, the differences in their attitudes appear to be great. On only three issues do a larger proportion of Freshmen and Sophomores than of Juniors and Seniors take positions favoring management. As can be seen in Table 2, the percentage of the beginning students who oppose continued growth in the political power of unions, who credit management with taking the initiative in providing improved worker benefits and who would use injunctions in local labor disputes is greater than the percentage of the advanced students taking these positions. An equal proportion of both groups oppose sympathy strikes and would weigh efficiency more heavily than seniority in making layoffs. On the 10 remaining issues, however, the percentage of advanced students espousing management views is higher than the percentage of the beginning students.

The differences between the answers of the two groups of students are significant in eight instances, and in each of these cases the views of the advanced students are more favorable to management. Differences significant at the five per cent level are found in the answers concerning sympathy with either party, preference for union or non-union working conditions, management encouragement of union membership, use of picket lines and responsibility for strikes. Differences at the ten per cent level are found between the answers of the two groups involving the union shop, growth in union bargaining power and the right to hire.

Conclusions

The study suggests that Auburn students are generally more sympathetic with management views than with those of labor unions. Even Education students and Freshmen and Sophomores appear to favor management on most concrete issues, though they picture themselves as more favorably inclined toward labor than toward management.

The only significant differences in the answers of the Education students and those of All students show that the Education students are: (1) less willing than All students to credit unions with taking the initiative in securing improvements for workers, and (2) less willing to allow unions to use picket lines.

Business Administration students in training for careers largely in management feel that their sympathies are with management to a significantly great degree than do the Education students. The most important differences between the two groups of students are these: a greater proportion of the Business students than of the Education students (1) feel that labor is more responsible than management for rising prices, (2) would permit picketing, and (3) would use injunctions in local labor disputes.

Business students differ significantly from All students only in that the Business students are less favorably inclined toward labor on the issues of (1) rising prices and (2) the use of injunctions.

Advanced students at Auburn, as elsewhere[4], appear to be more conservative than beginning students. This difference may or may not be due to their college training, but it appears to be quite pronounced. Juniors and Seniors picture themselves as significantly less sympathetic to labor than do Freshmen and Sophomores and the answers given by the two groups of students tend to substantiate this evaluation. Significant differences are found between the answers given by the advanced students and by the beginning students on the issues of (1) union as against non-union working conditions, (2) management encouragement of union membership, (3) the union shop, (4) growth of union bargaining power, (5) use of picket lines, (6) responsibility for strikes and (7) the right to hire.

FOOTNOTES

1. There were 224 students in other schools and 23 graduate, fifth-year and "special" students whose responses are not analyzed separately in this study.

2. Ten have been omitted to simplify the exposition and to eliminate questions which either were subject to misinterpretation, or dealt with less important issues.

3. That is, the differences observed would occur by chance fewer than five times if a hundred different pairs of samples of constant size were drawn from the same populations. Chi square was used to determine the significance of the difference. To simplify presentation levels of significance are indicated as 5 per cent or 10 per cent only, though the degree of significance may actually be greater.

4. See Willys R. Knight in, "Economic Attitudes of College Students," *The Atlanta Economic Review*, March, 1958, p. 4. Knight's study of Georgia state college students found Juniors and Seniors to be more "pro-management" on labor union issues and "more conservative" generally than Freshmen and Sophomores.

COAL RESERVE ESTIMATES ON A REGIONAL BASIS

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During the past seven years, it has been the writer's good fortune to have spent much time studying estimates of coal reserves which were made on a regional basis, attending conferences regarding the making and use of such estimates, helping make and extend regional estimates and even making some of them himself, in both Tennessee and Alabama. Six of the estimates covered areas large enough to be considered regional although only three included all beds in the particular area.

The problem of estimating original or remaining reserves in an entire field or region is quite different from that of estimating tonnages on a single tract, even if it is a rather large one.

Perhaps the greatest difference between the two problems is one of quantity and reliability of data. Estimates of reserves on a single property are seldom undertaken unless there are at hand results of considerable drilling test-pitting or prospect opening measurements. If drilling and test-pitting are done, the points are usually regularly and systematically spaced. Coal reserve calculations from this type of data are little more than exercises in arithmetic unless the data points reveal great variability in bed thickness. Even in the latter case, statistical treatments such as the "modulus of irregularity" formerly used by the USGS, or other more complex methods, will help prevent a great over-or-under-estimate of recoverable reserves.

In the case of regional estimates, however, the situation is quite different. The estimate must be made with the data at hand. (1) It is virtually impossible to do any drilling, test-pitting, etc., either to obtain data where none are available or to verify that which may be questionable. (2) Data varies greatly in reliability, possibly all the way from completely cored and logged diamond drill holes to statements like "thickness **reported** to be 48 inches." In using McCalley's Report on the Warrior field[1], however, it is refreshing to see how he apparently labels "reported" thickness to distinguish them from those he actually measured. Geologists haven't always been so careful! (3) General or regional geology is seldom useful in small scale estimates but it is indispensible to

regional ones with widely and irregularly scattered data points and large areas of no data at all.

The Classification of Reserves—The work of the USGS in this country has set the pace and largely determined the method for making regional coal reserve studies.[2] The USBM, consultants like Ford, Bacon, and Davis[3] and State Surveys such as The Illinois Geological Survey[4] follow essentially the USGS method.

Nearly every regional study is more useful if reserves are classified into a few special categories, depending on the objectives of the study. The following ones, used by the USGS, appear to be helpful in any estimate.

1. Rank of coal. The great influence of rank upon suitability for various applications amply justifies this classification. A secondary help is the light shed on the probable age and extent of deformation of the coal which, in turn, may affect coal field structure and coal recoverability in mining.

2. Grade of Coal. This factor is useful from the standpoint of coal utilization but is far more difficult to evaluate from a few scattered analyses than is rank. Again, regional geology may be helpful in studying general trends such as the westward increase in sulphur in the Pittsburgh bed in Pennsylvania and the northwestward sulphur content increase in the Black Creek group and some other beds in Alabama.

3. Thickness of beds. This classification is useful for those planning mining operations. The USGS classification of 0-14", 14"-28", 28"-42" and +42" with 14" representing the minimum limit for any underground mining, 28" for machine mining with hand loading and 42" for full machine mining, may be obsolete but they have been used so much that different estimates on that basis are readily comparable.

4. Thickness of overburden. Except for strip mining, classification by thickness of overburden such as the USGS cut-off point of 3,000 feet for all mining, 2,000 feet for mining with extra care and attention given to support and shallower than 1,000 feet where support problems are usually peculiar to a given locality, are perhaps more arbitrary than thickness classifications but they do measure, roughly, the increasing cost of mining with depth, if all other factors are equal.

5. Weight of coal. The USGS value for bituminous coal, 1,800 tons per acre foot, seems perfectly satisfactory.

Classification of Reserves by Probability of Occurrence—The most important classification of reserves, in the case of regional

estimates, is that of probability of occurrence. As stated by the USGS[2], this classification is based on relative abundance and quality or type of data. Following are the three specific reserve categories as named and defined by the USGS:

"Measured reserves—Measured reserves are reserves for which tonnage is computed from dimensions revealed in outcrops, trenches, mine workings, and drill holes. The points of observation and measurement are so closely spaced, and the thickness and extent of the coal are so well defined that the computed tonnage is judged to be accurate within 20 per cent or less of the true tonnage. Although the spacing of the points of observation necessary to demonstrate continuity of coal varies in different regions according to the character of the coal beds, the points of observation are, in general, about half a mile apart."

"Indicated reserves—Indicated reserves are reserves for which tonnage is computed partly from specific measurements and partly from projection of visible data for a reasonable distance on geologic evidence. In general, the points of observation are approximately 1 mile apart, but they may be as much as 1½ miles apart for beds of known geologic continuity."

"Inferred reserves — Inferred reserves are reserves for which quantitative estimates are based largely on broad knowledge of the geologic character of the bed or region and for which few measurements of bed thickness are available. The estimates are based on an assumed continuity for which there is geologic evidence. In general, inferred coal lies more than 2 miles from the outcrop."

The spacing of data points at about half a mile apart, for measured coal estimates, leaves little room for individual judgment, based on geological evidence. The implication—and the apparent practice—is that the ½ mile figure is a **maximum** and that the exercise of judgment would generally be as to whether or not to use a closer spacing.[5, 6] This logically means that if an arc is used to delineate measured coal about an isolated point, the radius would be ¼ mile. Where data are present along a well established outcrop for several miles, a band ½ mile wide, back of the outcrop, can be considered as measured coal.

Indicated coal apparently is based on essentially the same physical data as that used for measured coal but is projected a greater distance. The definition states the points are generally about 1 mile apart but may be as much as 1½ miles. Along an established, continuous outcrop a band of indicated coal 1½ miles wide may

lie back of the ½ mile strip of measured coal so that under these circumstances, indicated coal may lie up to 2 miles from the outcrop.

Data point spacing of 1 mile for indicated coal would call for arcs of ½ mile radius and spacing of 1½ miles, require ¾ mile radius arcs. Again the 1½ mile, or mile, figure is used, in practice, as a **maximum.**

The definition for inferred reserves, however, does not suggest any maximum distance from data points or outcrop but does suggest 2 miles as a "normal" **minimum** distance from an outcrop. In actual practice this appears to have been used as a "maximum" minimum or as an **upper limit** for **beginning** inferred reserve areas. If indicated reserves are limited to a distance of 1 mile back of the measured reserve area, estimated inferred reserves would necessarily have to **begin** at 1½ miles, not 2 miles, or if an isolated point, outside an arc of ½ mile radius.

As the areas covered by arcs are proportional to the square of the radius of the arc for isolated data points (ones about which there is no overlapping of arcs), areas would be, using the suggested USGS limits for measured and inferred coal:

$$(0.25)^2 : [(0.75)^2 - (0.25)^2] : [(1.5)^2 - (0.75)^2] = 0.0625 : [0.5625 - 0.0625] : [2.25 - 0.5625] = 0.0625 : 0.500 : 1.6875 = 1 : 8 : 27$$

It can be seen that, using the suggested USGS limits for measured and indicated reserves, the area of inferred reserves for isolated points will be three times the sum of the other two categories or 75 per cent of the total. Clayton G. Ball[7] notes that most major reserve studies in the past have resulted in roughly 50 per cent of the reserves being placed in the least probable, or inferred reserve, category. In cases where there is some overlapping of arcs the limits outlined above would result in less than 75 per cent inferred reserve areas. Where closely spaced outcrop data only are available and the reserves are all found in bands parallel to the outcrop, the same rule would result in nearly 50 per cent of total reserve areas classed as inferred. Thus, if purely mechanical delineation of all reserves is used, inferred reserve areas should range from 50 to 75 per cent of the total. In elevated, deeply incised plateau areas such as eastern Kentucky, Tennessee and northeast Alabama, where dips are small, for the higher beds arcs not only will overlap each other but because of the narrowness of the ridges underlain by the beds, they often will overlap the opposite outcrop. This results in inferred reserve areas which calculate out nearer to 50 per cent of the total. For lower beds, in cases where

there is little overlapping of arcs swung from the outcrop and where large areas of little or no data are left under the larger mountain masses, the proportion of inferred reserves should approach 75 per cent of the total. This does not necessarily mean that the higher beds will be overestimated or the lower ones underestimated. The lower beds will almost certainly have a larger proportion of area excluded for lack of data, all other factors being equal; therefore, the ratio (tonnage estimate/true tonnage) should be about the same for high or low beds in such fields.

The implication of the inferred reserve definition of the USGS is that mechanical methods are not to be paramount but that the limitations to be placed on inferred reserve estimates are based principally upon the judgment of the geologist or geologists making the estimate. Thus, as stated above, no **upper** limiting distance from data points is suggested and the only minimum one is 2 miles, or less. "Broad" evidently means "general" and "bed characteristics" may be determined as "geological environment." Evaluating this environment and "good geologic evidence" for continuity readily involves theoretical geology regarding the origin and post-deposition geological history of the coal beds. It is not often that coal reserves can be inferred solely upon geological theory, but theory often guides judgment. For example, if a coal bed abruptly disappears, the chances that it will come in again in a short distance are good if it can be shown that the coal was removed by a river channel cutout. But if it can be shown that a shale above the coal conformably (or nearly so) overlaps beds underneath it, as would be the case at the edge of a depositional basin, the chances for the bed to appear again are not good.

If inferred reserves are to be determined mechanically, there should be a category of "extended inferred" reserves upon which to exercise judgments based wholly upon geological conditions. If inferred reserves, however, are not estimated mechanically, such a category would not be needed. The argument can be made, of course, that the place where geological judgment can be used is in the determination of when and how far to use mechanical extrapolation. This writer is inclined to feel that any mechanical restrictions—even a basic one like length of arc—violates to some extent the "spirit" of inferred reserve estimates. The term "inferred" itself, as well as the entire USGS definition of inferred reserves, implies more than extrapolation according to a set of rigid rules. To guide relatively inexperienced personnel and personnel not thoroughly familiar with the area, rules and formulas

can be justified. The limitations suggested herein are not meant to be prohibitions but "go slow" signs.

A strictly mechanical extrapolation of data can result in ridiculous-appearing map patterns. If an arc comes close to an outcrop on the opposite side of a ridge, if a narrow wedge is left between two adjacent arcs, or if the tip of a "peninsula" on a continuous outcrop is left outside an arc, such areas should be included. (C, Fig. 3) As the arc itself is an arbitrary extrapolation,

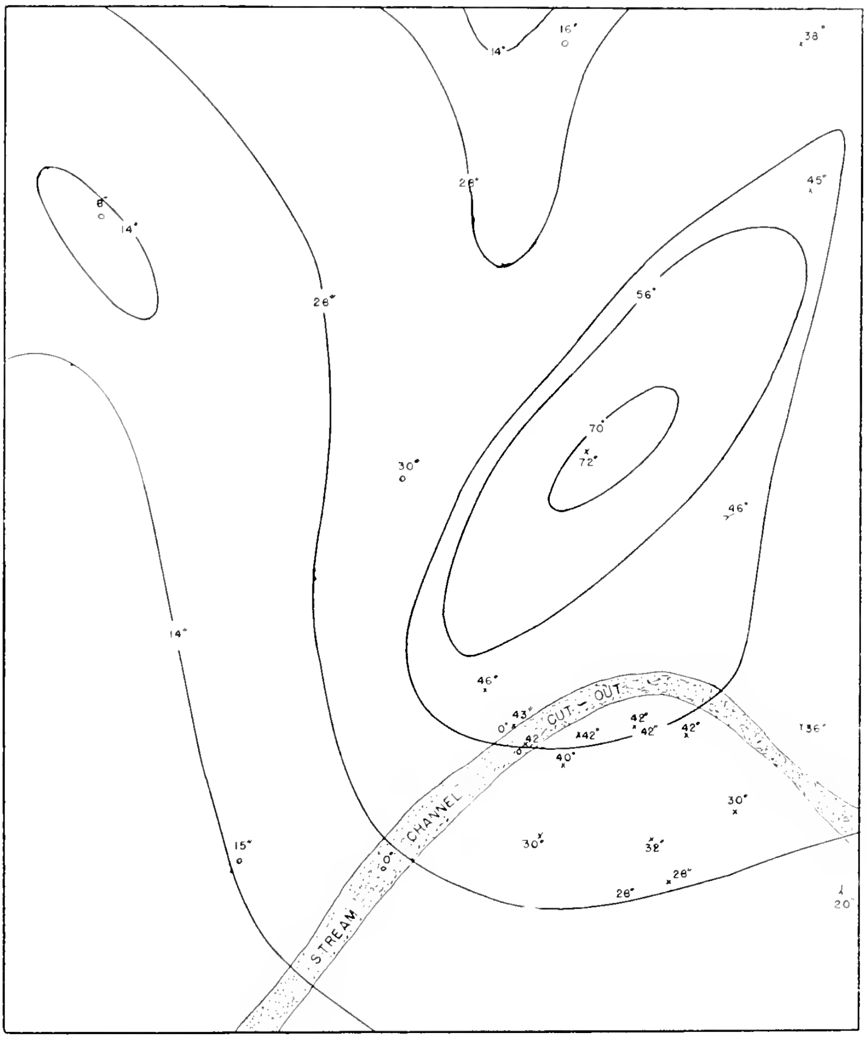


FIGURE 1

a "rounded off" extrapolation is little or no more improbable than the original one.

Limits of Accuracy—In comparing USGS definitions of the three reserve reliability categories, it will be noted that only the measured one has a guaranteed accuracy. Limits are so chosen that the chances are almost negligible the area will carry coal tonnages outside 80 to 120 per cent of the estimated quantity. No statement is made as to the probable variation of quantity in the

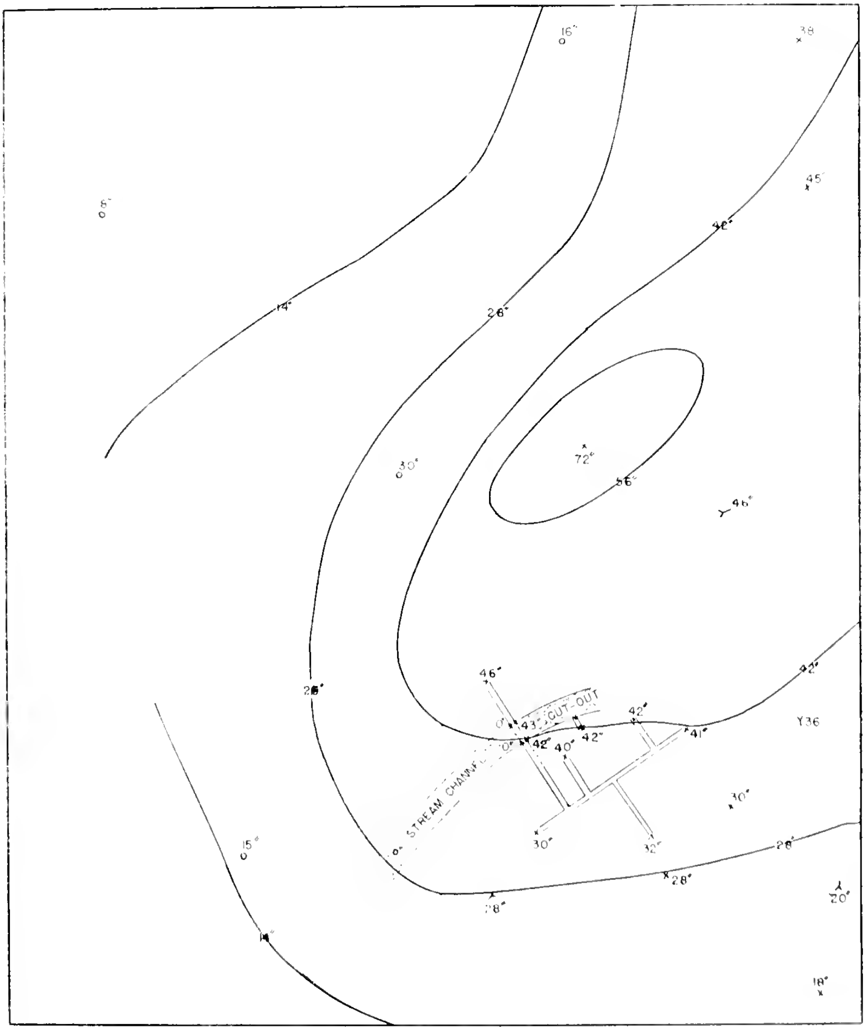
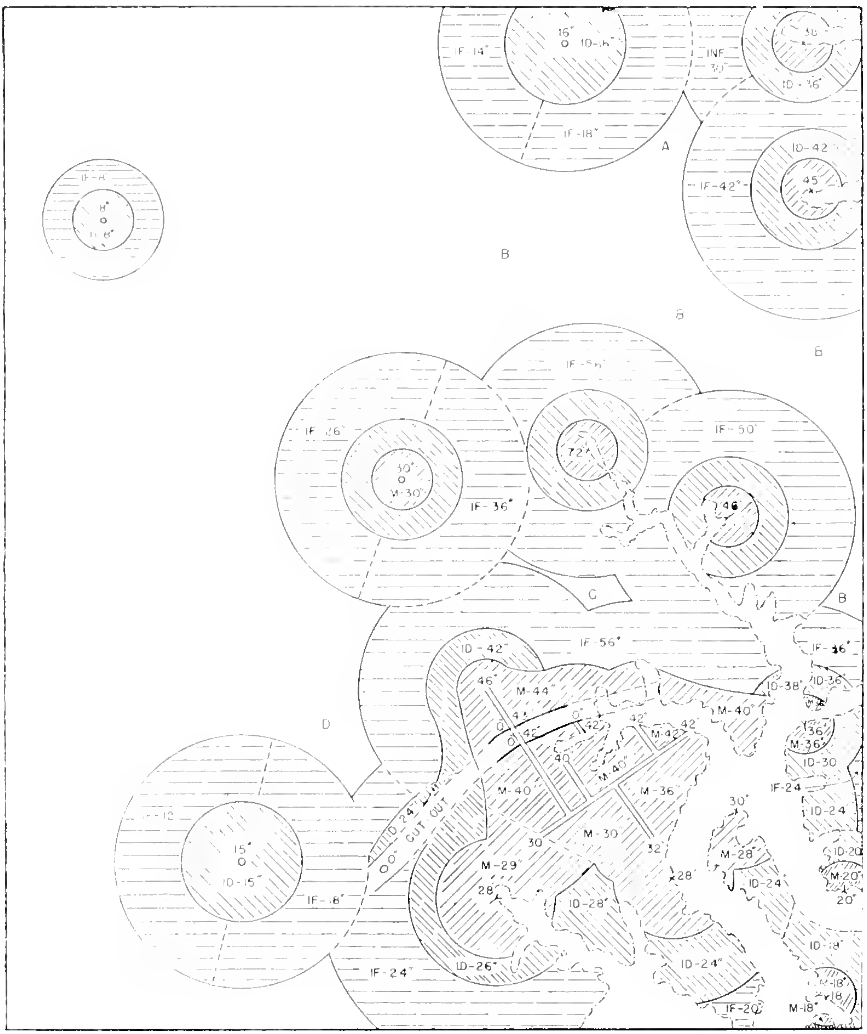


FIGURE 2

other two categories. In cases where measured reserves are present, indicated reserves are based on no additional or separate data. In isolated localities, indicated reserve estimates are almost exclusively projections of data taken at one point only. Inferred reserves are purely extrapolated values, and they are extrapolated farther than indicated reserves.



OUTCROP OF BED
MEASURED RESERVES
INDICATED RESERVES
INFERRED RESERVES

1 ½ 0 1 MILE

FIGURE 3

The USGS refers to the division into three groups as classification according to "abundance and reliability of data." As part of the indicated reserves are based on the identical data as measured reserves, there can be no difference in reliability of basic data without regard to distance. The categories just as truly represent degrees of **probability.** Indicated reserves are almost certain to be outside ±20 per cent limits; possibly ±50 per cent or some other figure. Conceivably, purely extrapolated reserves, whether indicated or inferred, could be in error up to minus 100 per cent and plus an even greater figure, not considering the general geologic evidence. However, the chances are small that indicated reserves are much too large and not appreciably greater, that they are much to small. Inferred reserves can be entirely missing but the chances again are small that they have been greatly overestimated. Inferred reserve estimates then, and to a lesser extent, indicated reserve estimates in cases of pure extrapolation, represent not "firm" estimates of coal tonnage but estimates of the probable **maximum** tonnage in the area to which they are restricted. In this sense, they are both **probability** categories, as is the measured category, by definition.

Suggested Rules for Southern Appalachian Reserve Estimates —The following rules are suggested for outlining areas of measured, indicated, and inferred coal. They are illustrated in Figures 1-3.

1. If, when arcs of ¼ mile radius are struck about data points, the arcs overlap, touch or almost touch, all the area should be classified as measured along the outcrop. If the measured outcrop exceeds 1 mile in length, the measured reserve zone should extend back ½ mile from the outcrop.

2. If variations in bed thickness shown by adjacent data points are not too great (ratio of 2:1 with minimum of 14 inches is suggested), a second band one mile back of the outcrop should mark the maximum limit of indicated coal. If the outcrop is 2 miles or more in length, the indicated coal band should extend 2 miles back of the outcrop or 1½ miles back of the measured band.

3. If the coal, in closely spaced measurements, shows great irregularity in thickness, these radii of arcs should be cut in half and the same procedure followed.

4. Isolated data points, particularly drill holes, that are somewhat more than a mile from any other point should delineate no measured reserve area but a "normal" arc (½ mile) for indicated

coal can be struck about them unless the area is suspected to be one of thickness irregularity. In this case, the arc radius should be cut to half of "normal."

5. In general, coal adjacent to small abandoned works (not prospect pits but mines) can be classed as measured, even if mine maps give no thickness data. It is true that some small mines were abandoned because the coal in them had thinned, or become too low grade to work, but more often they were abandoned because haulage became too long or demand or price altered for the worse. If the works are **extensive** and there are no thickness data, areas next to them are best placed in the inferred category because of the possibility that work was abandaned because of thinning, etc. If a side of the abandoned works is straight, and a property line is not known, the coal may be cut off by a fault on that side, in which case the area across the fault should be excluded unless positive data supporting the trans-fault presence of the coal are known.

6. Steeply dipping coal of sufficient thickness may be included in reserves, but a footnote in the tables should indicate that mining will be difficult. [The southeastern boundaries of the Cahaba field (Alabama) and the Middlesboro basin (Kentucky and Tennessee), are examples.] The same notation should be made for areas known to contain extensive partings, areas badly faulted, areas of known poor roof conditions, and areas of highly variable, even if generally adequate, thickness.

7. Coal next to strip pits more than ¼ mile long should be measured and indicated, even if thickness data points are not within ½ mile of each other. If there are no known thicknesses close by, adjacent areas still may constitute inferred reserves of thickness indicated from isopach maps.

8. Reserves based on drill holes and outcrop data **systematically** or **regularly** spaced in two dimensions, can all be classified as measured coal, even if up to a mile apart, provided thicknesses are uniform or changing only slightly in some definite direction. Otherwise, the arc rules should be followed with areas between or beyond measured and indicated areas, classified as inferred reserves.

9. Measured reserves should be less readily assigned in districts where there has been extensive mining activity than would be true for exactly the same data in an unknown area because of the greater chances for mineable coal to have been discovered and already mined out in the better known region. The same rule can

roughly be followed by showing more conservatism in estimates of reserves in low beds than for equivalent data on the higher ones, in high plateau regions.

10. Areas delineated on the basis of reliable data but with some uncertainty as to location such as Glenn's description, "a mile up Beech Fork a facing at Alfred Cross's on the north side of the creek shows a tough shale roof, top coal 12 inches, sulphur and rash ½ inch, coal 11 inches, hard gray floor 8 inches with sandstone underneath"[8], should be classed as indicated coal rather than measured because older geologists, even when reliable as Glenn usually was, were handicapped in giving locations that are readily checked now.

Suggestions for Estimating Reserves in the Inferred Category—

1. The most obvious basis upon which to infer a definite quantity of coal is a mechanical extension of the method of arcs used for the measured and indicated categories. As noted, no maximum arc radius is given by the USGS definition of inferred reserves but a good rule-of-thumb probably would be to use a radius double that used as the maximum limit to indicated reserves which would be, in most cases, as suggested above, a radius of 1 mile. There probably should be one exception.

2. The exception is the isolated data point (usually a drill hole) in unknown areas or in areas of suspected bed thickness irregularity. As the mechanical extrapolation normally gives three times the area of inferred reserves as of the two other categories combined, the radius of extrapolation should, in this case, be cut to the square root of 2 times the indicated coal arc radius so that inferred area will equal only the sum of the other two categories. This would usually be 0.5 times the square root of $2=0.5 \times 1.414=$ 0.707 miles.

3. As suggested above, in the general discussion, narrow areas between an arc and the outcrop on the opposite side of a ridge or on a branch of a main ridge on the same side, narrow wedges between arcs and the tips of "peninsulas" on otherwise continuously known outcrops, should be included in inferred coal in order to avoid arbitrarily ragged patterns. In general, such included areas should be narrower than the radius of the arc used for inferred reserves.

4. As a guiding principle, the areas named in 3, above, should be included only when persistency and thickness regularity were judged to be such as to justify the use of the "normal" or longer arcs.

5. "Extended reserves" probably have no basis in the data for beds so high in plateau regions as to underlie only areas of long narrow ridges and which are so far apart that isopach maps are almost useless.

6. Where isopach maps can be made and the data are plentiful enough to make it improbable that the isopach pattern could be radically different from that indicated, inferred reserves may be based upon the isopach pattern. Isopach pattern alone may rarely be sufficient evidence for extended inferred reserves but a favorable pattern coupled with one or more of the following conditions should be sufficient.

a. Mineable coal on three sides and only a little more than a mile away.
b. An unusually persistent horizon which carries coal at every place seen in the local area.
c. A persistent coal zone just above or just below a sandstone and conformably related to it.
d. A persistent zone in a predominantly shale section with enough sandstone to indicate shallow water and shifting conditions necessary for coal swamps to form and be buried.
e. In areas where all clastic sedimentary units appear to be persistent and free of sandstone cutouts or sandstone with marked unconformities at the base.
f. Areas believed to be free of shear or shatter zones.
g. Areas believed to be free of irregularities, structurally induced, such as rapid or excessive thickening or thinning, excessive undulation, etc.

The last two conditions are normally absent in Tennessee except near the Walden Ridge front, the Jacksboro and Pine Mountain faults, etc., and in Alabama except possibly along the southeast boundary fault of the Coosa, Cahaba, and Warrior coal fields.

Suggested Procedure for a Regional Reserve Estimate: 1. Plot all thickness data for a bed on blank transparent base maps with quadrangle lines but no outcrops in order that outcrop lines will not unconsciously influence the drawing of isopach lines.

a. Make an isopachous map only when about 50 per cent or more of the quadrangle is included inside the outcrop and data points are fairly numerous. Isopach patterns for adjoining areas should be reconciled before final patterns are drawn.
b. Even where thickness data are sufficiently plentiful to permit drawing isopach lines, if the bed thickness is highly var-

iable and the evidence is that the bed is subject to abrupt and highly localized thickening and thinning, it is doubtful that drawing isopach lines will be worthwhile.

2. If isopach maps are made, draw lines at 14, 28, 42, 56, and 76 inches (Figure 2).

3. Use the bed and its partings as the stratigraphic unit for isopach lines unless the parting is clearly widening in some definite direction or if it is thicker than any individual bench. This does not mean that the partings are included in thicknesses used for reserve calculations.

4. If an isopachous map is not made and there are many data points in a given area, use an arithmetic average of thicknesses, less partings ⅜-inch or thicker, for reserve calculations.

5. If there are few points, divide the area into polygons by means of straight lines perpendicular to the lines between adjoining points. The weighted average thickness may then be obtained as the sum of the products of each individual polygon area by the thickness at the center of the polygon, divided by the sum of the areas of all the polygons.

6. If a satisfactory isopach pattern is found, the pattern superimposed on a map of the outcrop will usually give, as the average thickness, the isopach line running nearest the center of the area to be computed, or the average of those through the area. The estimated average thickness of partings ⅜ inch and thicker must be subtracted to give the figure to use in tonnage calculations unless **mining** tonnage is desired.

7. If isopach lines are close together or are irregularly spaced, break the total area up into subareas, each of which is traversed by no more than three isopach lines and use the middle one for the average.

Note: In general, basins of thick coal revealed by isopach lines may be expected to trend NE-SW or at right angles to this direction. The ancient shore line usually lay to the south or southeast of the coal accumulation areas as is shown by the northwestward thinning of most stratigraphic groups and many units in Tennessee[10] and probably in Alabama. If the coal were deposited in lagoons off shore, basins should trend NE-SW parallel to it; if in swamps along sluggish rivers, NW-SE parallel to them. Contrary trends are not impossible but should be carefully checked to see if they may have resulted from fortuitous location of data points, the influence of cut-outs or from forcing widely-spaced points into a single pattern. Deciding the true pattern is a matter of judg-

ment, not rules, but it deserves special study. In the Warrior coal field of Alabama the "grain" of the deposition is not so clearly NE-SW or NW-SE as in other fields.[10]

8. After isopach lines are drawn, the outcrop lines may be drawn in on the same worksheet or on an overlay.

9. For deeply buried beds (Popular Creek in Campbell and Anderson Counties, Tennessee, or the Gould in the Cahaba field of Alabama) it may be well to choose a maximum cover figure such as 1,000 feet (used by the USGS) and draw in the contour 1,000' above the bed. This is best done on an overlay if one is used and is best accomplished by preparing a structure contour map to be used as an overlay for a topo map. In general, this will not change reserve estimates as there probably will be few data points within the area, but it will make it possible to include in the final estimate a figure for reserves under 1,000 feet or more of cover. In deeply buried fields 2,000' and 3,000' lines may be drawn, if reserves beyond 2,000' depth can be estimated.

10. If it is desired to estimate strippable reserves separately, an overburden limit line can also be drawn at suitable heights above the outcrop. The USGS in the Indiana reserve study[5] used a 40-foot overburden limit for 14 to 28-inch coal, 60 feet for 28 to 42-inch coal, and 90 feet for coal thicker than 42 inches. These figures are consistent with present practice but allow little room for improvement in strip mining technology in Indiana. The Illinois Geological Survey[9] drew overburden isopachs of 50, 100, and 150 feet without primary reference to bed thickness. Strip mining conditions are much more severe in Alabama and Tennessee than in either Indiana or Illinois so that the Indiana figures, practical for that state, are probably maximum for Alabama and Tennessee and may be used. Where the steepness of terrain exceeds about 1:2 it hardly seems worthwhile to draw the overburden lines; they are so close to the outcrop lines. Probably the best plan, if overburden isopachs are to be drawn, is to put all isopach and outcrop lines on an overlay.

11. Worked-out areas, whether abandoned or not, and stripped areas should be plotted on maps and their outside boundaries, including adequate barrier pillars, clearly shown.

a. Many contour strip pits are so narrow that they can hardly be measured even on 7½-minute quadrangle maps. In such cases the pits should be mapped but not measured nor the tonnage subtracted as it is so small in proportion to the remaining reserves.

b. An area of coal left between mines or within mines should not be included in reserves unless it is large enough to support a small mine with adequate barrier pillars.
c. Some coal is recoverable from pillars in old mines having a suitable roof but the uncertainty of ultimate recovery is great enough to warrant omission from reserves of all such coal. In general, mined-out areas, plus pillars, isolated areas and barrier pillars, should be excluded in a solid block.

12. If there is no way to outline mined-out areas but figures for production from the area and for the particular bed can be obtained, remaining reserves can be calculated, but not fully located, by subtracting cumulative production (plus 5 per cent or another suitable arbitrary figure for unrecorded production), from calculated original reserves.

13. After all information has been placed on the original tracing and/or any overlays, the outcrop lines of the bed being estimated should be traced in on the base map. By placing outcrop lines last they will have no influence on the drawing of isopach lines or on dividing the area into thickness category sub-areas. Before outcrop lines and overburden isopachs are added, the base map will be an interpretation of the dimensions of the bed as it was before erosion. Outcrop and overburden isopach lines on the overlay will represent the changes produced in the bed by erosion and structural movements, in three dimensions.

An Example of Reserve Delineation using Hypothetical Data: Figures 1, 2, and 3 illustrate the treatment of a set of hypothetical data for a 7½ minute quadrangle (1:24,000 scale).

In Figure 1, the isopach lines, or thickness contours, show the thickness trends of the coal bed as they actually existed after deposition, burial and compaction. In the southeast ¼ of the quadrangle, a post-deposition stream channel has removed the coal as shown but the isopach lines have not been modified to this feature. Shown also are the location and thickness of every known bed measurement. This drawing thus represents the bed as it now lies and with all of the information which will be used for reserve estimation. Only the outcrop line, of the information which will determine the size of the estimated tonnage, is not shown.

Figure 2 shows the same bed thickness data as Figure 1, again without the outcrop line. The isopach lines that are sketched in on Figure 2 were drawn solely on the basis of the data at hand. There are many differences in detail between the isopach patterns

of Figure 1 and 2 but in spite of the scarcity of data, the pattern of Figure 2 is fairly good, particularly in the areas, as expected, of the more numerous data points. The principal differences are:

1. The course of the river channel cannot be traced completely in Figure 2 but it can be inferred for more than a third of its length.

2. The thin-coal area and exact thickness pattern in the north central part of the quadrangle were missed so that the 28" contour line was drawn too far to the east and much coal of near-mineable thickness was missed.

3. The thin coal spot in the northwest corner was made a large region with the coal thinning toward the west rather than a comparatively small area of coal thinner than 14".

4. The thick-coal basin in the east central part could not be closed on the northeast. It must be admitted that detail and spacing of the contour lines (they were sketched in by eye) in Figure 2 would be different for every individual estimator although possibly differences in the over-all pattern would be slight.

The interpretation of the drill holes and of the entries where coal thicknesses of zero were found would be dependent largely upon observations underground in the mine. The cross-entry driven through the cut-out and revealing abrupt change from 42" coal to no coal and within 0.2 mile, another abrupt change from no coal to 43" would indicate a stream channel, particularly if the coal-barren material were sandstone. The short drift reaching the cut-out and the one drill hole in which coal was wanting, are easily placed in the river channel cut-out pattern.

In Figure 3, areas of measured, indicated and inferred reserves of coal, together with their estimated average thickness, are shown. These were delineated in accord with the procedure and principles set forth in this paper with a few judgement modifications.

It will be observed that the distances and areas used for the delineation of areas have varied somewhat with the quantity of data available. In the northeastern quadrant, every locality shows a good thickness of coal but they are so far apart that measured and indicated reserve areas were not connected up. An arc with radius of ¼ mile was used for measured reserve areas, one of ½ mile radius for indicated reserve areas and one of 1 mile radius for inferred reserve areas. None of these arcs touched, except those for inferred reserves so that these were the only ones that were connected. Near the center of the southeast quadrant, near the developed mine, however, the thicknesses shown are so uniform, they match the isopach pattern of Figure 2 so well (accept-

ing the river channel cut-out explanation of the barren areas, of course), that arcs of ½ mile radius were fused into a rather large measured reserve area in spite of the fact that some data-point distances exceeded these suggested in the rules, in parts of the area. Inferred reserve arcs were expanded to 1 mile radii except to the northeast and northwest of the mined area where indicated reserve bands were cut to ¼ mile width. The same thing was done to the southwest of the mined area but here the ¼ mile wide indicated reserve areas were outside ½ mile arcs of measured reserves. Had more faith been put in the accuracy of the isopach pattern of Figure 2, all measured reserve arcs in the eastern half of the quadrangle would have had ½ mile radii and all indicated reserve arcs, at least 1½ mile radii.

The lone drill hole near the northwest corner of the quadrangle was assigned no measured reserves but circles of ¼ and ½ mile radii were used to delineate indicated and inferred reserves, respectively. In brief, because there was no supporting evidence, except drill holes 2½ miles to the southeast and 4 miles to the northeast, the arcs used were cut to ½ of "normal" for the remainder of the quadrangle.

It will be observed that "normal" arcs were used for the drill hole near the southwestern corner and for the one near the north-central adge of the quadrangle because they were much closer to areas of known characteristics. In both cases, however, measured reserves were omitted. The drill hole showing 30" of coal near the very center of the quadrangle is over a mile and a half from another point but on the strength of a good thickness of coal and the isopach line pattern of Figure 2, measured reserves "normal" for an isolated point, were estimated.

The areas of inferred reserves shown in Figure 3 were all determined and limited mechanically. What of the areas designated on the map by letters A—D? Which of these could safely and logically be included with inferred reserves?

Certainly there can be no doubt concerning area C. It is a narrow wedge, arbitrarily excluded, between areas inferred to be underlain by coal of mineable thickness. As inferred reserves are themselves extrapolations, excluding an area like C is no more logical than carrying an admitted estimate to five decimal places!

On the basis of the isopach line pattern of Figure 2, the two upper eastern-most areas marked B may be inferred to be underlain by coal 28 inches or more thick, but thickness probably should be lowered to a conservative 21-24 inches if areas A and western-

most B, are inferred. The lower eastern area marked B apparently could safely be inferred to be underlain by 42" thick coal. In this case, however, and that of the B area just above it, any information on the quadrangle to the east should certainly be considered before reaching a decision.

Area D is almost identical in position to western-most B; reserves probably are fairly safely inferred but a cautiously assumed thickness of not more than 21 inches should be used.

To sum up: area C would be included in inferred reserves even by a conservative estimator. Southern-most B probably would be included also if data from the quadrangle to the east were missing or not unfavorable. Only a more daring or confident estimator would include the others with no additional prospecting. A general study of the stratigraphy and depositional environment, including the probable direction of the sediment source, direction of thickening or thinning of sedimentary units, etc., probably would decide the disposition of these areas, at least for the careful but not definitely conservative estimator.

Acknowledgements

The author wishes to express his indebtedness to his clients of the past seven years for their patience with this particular brand of crystal gazing and especially to the Tennessee Valley Authority for its excellent support of regional coal reserve studies and for the opportunity thus afforded to study reserve estimates of others and to participate in such studies with men who are better qualified as geologists and engineers than is the author. As a teacher, he knows that this is the best way to learn!

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SOME UNUSUAL LEMNISCATES

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Mathematics is the most exact of the sciences, and consequently we would not expect to find errors in mathematical text-books, or differences of opinion among mathematicians, as there often are among geologists, biologists, etc. But some statements on mathematical topics in current dictionaries and encyclopaedias are inaccurate, as if based on incomplete or misleading information in the text-books.

The problems to be discussed at this time are connected with lemniscates. All I have seen illustrated in text-books are symmetrical, both up and down and sidewise, and have their branches crossing at right angles, or nearly so. But they can have many shapes while still symmetrical. In a paper presented to this section in 1956, on ovals and related curves, I described and figured several kinds of unsymmetrical lemniscates; and I now have some additional kinds to present.

In my 1956 paper I mentioned that a linkage devised by James Watt in connection with his steam engine, in 1784, could be used to trace a lemniscate. But it seems that I may have been mistaken in ascribing the lemniscate to Watt, for that seems to have been a later development from his linkage. The Encyclopaedia Britannica article on "Curves, special," shows an example of Watt's linkage, which is the simplest possible one, with three bars. In their figure the end bars are equal in length, the middle one over twice as long, and the base line or distance between pivots nearly

four times. The statement is made that if a piston rod is attached to the central point of the middle bar it will move up and down in approximately a straight line while the end bars rotate (through part of a circle).

Webster's Dictionary (1909 edition), under the head of "straight line," describes several contrivances for drawing a straight line without a ruler, some of them linkages and some not. Watt's linkage is illustrated very simply, by a zigzag line something like a letter Z with elongated upper and lower arms, extended in an approximately horizontal direction, with a dotted vertical line intersecting it at the middle; that presumably representing the vertical line that Watt sought. But a linkage set up in that way produces something very different, as I will explain presently.

Watt's linkage can be varied indefinitely by changing the length of the bars, the distance between pivots, and the position of the marking point; but I have found no arrangement of it that will give the marking point anything like a straight up-and-down motion, such as is indicated by both dictionary and encyclopaedia. The illustration of Watt's curve in the Encyclopaedia shows an upright lemniscate, a little narrower than a typical one, but still far from a straight line. It goes on to say, however, that under special conditions, with the middle bar equal to the base line, and the end bars related to the middle bar as half the square root of two to one, the marking point will trace a lemniscate of Bernoulli. But they neglected to state that that lemniscate will be horizontal. (See under Yates, farther on.)

I have constructed a linkage with the same proportions as those shown in the Encyclopaedia Britannica, and drawn several curves with it. The one traced by the middle point of the middle bar is a lemniscate, but instead of being nicely rounded as in the Encyclopaedia figure, it is somewhat flattened at the ends, and straight or nearly so for some distance near the node. (See Fig. 1.)

The linkage figured in the dictionary is on such a small scale that it is hard to match exactly, but evidently its end bars are so long that they would overlap, and the middle bar is shorter. A mechanism constructed on that scale gives a lemniscate departing more widely from the type than that just mentioned, with the sides apparently straight for a considerable distance, and the ends more flattened; something like a letter X with its ends closed by flattened curves. That may be what Watt had; but to get a vertical motion with it he would have had to put his pivots at dif-

ferent levels. To save space, I am not illustrating that here; but any one sufficiently interested can draw it for himself, with compass and ruler.

Going back now to the linkage of the Encyclopaedia type, if we put the marking point elsewhere than at the center of the middle bar, the resulting lemniscate immediately becomes lop-sided, and its two flex points do not coincide with the node, as they do in typical lemniscates. As we approach one of the joints, it narrows, and at the joint it becomes a mere arc of the circle generated by the end bar revolving about its pivot. Farther out the lemniscate widens out again, and also straightens, which is shown in the figure, but I could not carry it very far in this limited space.

R. C. Yates, in his book, "Curves and their properties" (1947), has a short chapter on lemniscates, and in the introductory paragraph he mentions Watt's linkage, and states that by the use of it Watt was able to reduce the height of his engine-house by nine feet. But there is no explanation of that, and no diagram to show how it worked. The only lemniscates shown in that chapter are two made by ingenious modifications of Watt's linkage, which, while still keeping the pivots on the same level, produce horizontal

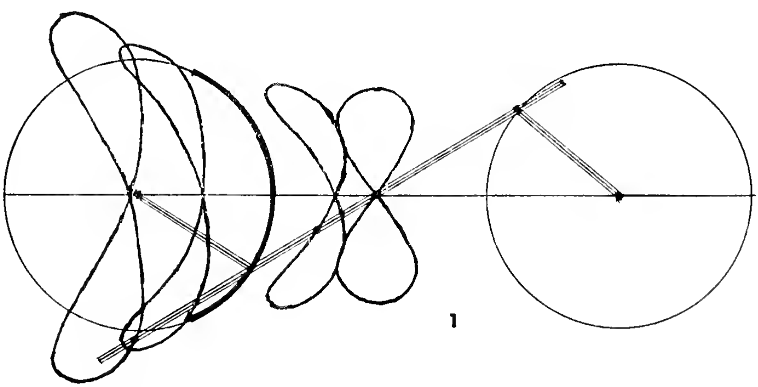

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Fig. 1 Some lemniscates made by a Watt linkage with the same proportions as the figure in the Encyclopedia Britannica. The symmetrical one at the right was made by a marking point at the center of the middle bar, and the others by moving the marking point to the left, two of them beyond the pivot. The heavy line on the circumference of one circle represents the case with the marking point at the pivot. One position of the bars is indicated, with the marking points on it, showing that corresponding points on different curves are quite different.

instead of vertical lemniscates. They are not drawn completely, but are apparently alike, and perfectly typical, though made by quite different arrangements of the bars.

In one the middle bar is the same length as the base line or distance between pivots, and the end bars are a little more than half as long, so that the circles traced by them would overlap. The central point on the middle bar traces a neat lemniscate, which encloses the pivots. But if we move the marking point we get some surprising results. Put it one-fourth of the way between joints, and it traces what is essentially a parallel curve to the lemniscate, outside of one lobe and coming to a point near the middle of the other lobe. But put the marking point the same distance beyond the joint, and we get another surprise, not a lemniscate at all, but a rounded curve concave on one side, much like what I called a faboid in 1956. All this is illustrated in Fig. 2, with one position of the linkages.

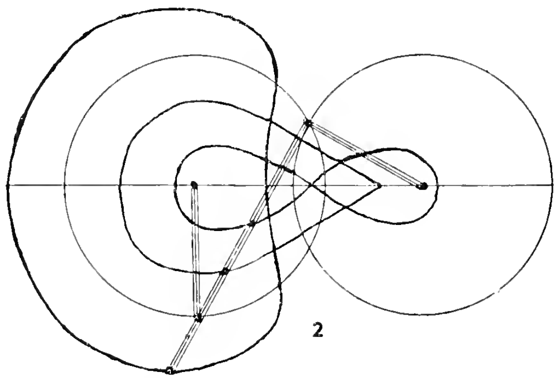

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Fig. 2 Some curves made by one of Yates's modifications of Watt's linkage (here drawn with compass and ruler instead of linkage). The one extending farthest to the right is a horizontal lemniscate, presumably corresponding to Bernoulli's pattern. Next is a parallel curve to it, coming to a point inside of one lobe of the lemniscate, while at the left is what I called a faboid in 1956. One position of the linkage is shown, with the marking points on each curve.

The other lemniscate figured by Yates is produced by a linkage with end bars unequal, and the marking point outside the joint, on the side of the shorter bar. Strange to say, it gives another lemniscate, much like the one just mentioned. But if the marking point in this instance is put nearer to the joint, it gives another horizontal lemniscate, but with unequal lobes. Put it midway between joints, and we get still another surprise, a curve

suggesting a partly eclipsed sun, or a crescent moon. We might call it a moon curve for convenience. All this is illustrated in Fig. 3.

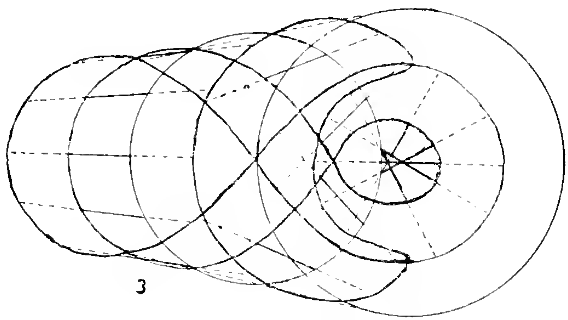

Fig. 3 Curves made by another of Yates's modifications of Watt's linkage, with unequal end bars. The one farthest to the right is a true lemniscate, with branches crossing at right angles. Partly inside and partly outside of it is a lemniscate with unequal lobes, and in the middle what is here called a moon curve. Corresponding points on the three curves are connected by dotted straight lines.

An infinite variety of curves, some lemniscates and some not, could be produced by modifications of Watt's linkage, but space will not permit further consideration of them here.

Most analytic geometry texts mention the lemniscate of Bernoulli (invented by Jacques Bernoulli toward the end of the 17th century, a time of great activity in European mathematical circles), but tell little or nothing about what other kinds there might be. They also commonly state, or at least imply, that the branches of a lemniscate should cross at right angles. A common definition of Bernoulli's lemniscate is that it is the pedal of an equilateral (rectangular) hyperbola, that is, the locus of the intersection of a tangent to the hyperbola and a line drawn perpendicular to that tangent from the origin. That indeed gives a neat lemniscate, with rounded ends and a right angle at the node. But change the angle of the hyperbola, and the lemniscate changes too. A hyperbola with an acute angle between its asymptotes (as commonly drawn) produces a lemniscate with an obtuse angle and flattened ends, and conversely an obtuse hyperbola produces an acute lemniscate. This is so obvious that I have not drawn a figure for it, but some lemniscates with similar variations will be discussed farther on.

Another commonly accepted definition of a lemniscate is that

it is the locus of a point the product of whose distance from two fixed points or foci (instead of the sum as in the ellipse) is constant. It may not be identical with the one developed as the pedal of a hyperbola, for that has no foci, and each type has variations not common to the other. For example, modifications of this constant (or parameter) can also produce a pair of ovals, known as Cassinians, and various other curves without nodes, but all symmetrical in two directions like the lemniscate.

It is also well known that these Cassinian curves can be produced by slicing a doughnut-like ring, or "tore," by a plane perpendicular to it. If the cutting plane is tangent to the hole, the edges of the cut will form a lemniscate. If the ring is slender, like a wire hoop, the lemniscate and most of the other curves will be slender. In fact its central angle can be varied practically all the way from 0° to 180°. The ideal condition (though not so specified by Yates) seems to be for the diameter of the hole to be equal to the thickness of the ring, which gives a perfectly respectable lemniscate, with branches crossing at right angles. But reduce the diameter of the hole to 0, and the lemniscate becomes two circles of the same size, tangent to each other. The equation for that should be very interesting.

There are still other complications when the plane cuts through the doughnut without touching the hole, but those are already well known. If the plane passes through half way between the hole and the outer edge, the resulting curve will look much like an ellipse, but will be flat for an infinitesimal distance at the ends of its short axis, and its evolute will have a pair of cusps at infinity, and will look much like a pair of conchoids or tractrices.

Now instead of cutting the doughnut by a plane at right angles to it, let us tip the plane. If it is still tangent to the hole, it will still produce a lemniscate, but a lopsided one, something like those I have already figured in connection with Watt's linkage. And if it goes through the center of the hole at an angle, it will produce some broadened-out ovals, something like some of those in my 1956 paper on ovals.

In that paper I started out with a method I had used about 1896, and published in 1910, to produce ovals, starting with a circle, and a focus on one side of it and a directrix on the other. Putting the directrix between the focus and the circle produces some exaggerated ovals, something like those just mentioned, and putting the focus inside the circle produces lemniscates, symmetrical if the focus coincides with the center of the circle, otherwise not. These

lemniscates may be fundamentally different from those of Bernoulli and also those of Watt, for they are constructed in a very different way.

In Fig. 4 I have superposed three such lemniscates, with angles between their branches of 60°, 90° and 120°, resembling the pedal curves of hyperbolas with similar angles, and roughly sketched their evolutes. In the 60° one, with the directrix distant from the governing circle a distance equal to its radius, the points of sharpest curvature should be at the ends, and the evolute should have a cusp on the main axis somewhere out that way, sweeping back to the asymptotes, which are the normals at the node, diverging 120°.

But the 120° lemniscate, being partly outside the circle, is necessarily flatter than the circle at the point of contact, so that

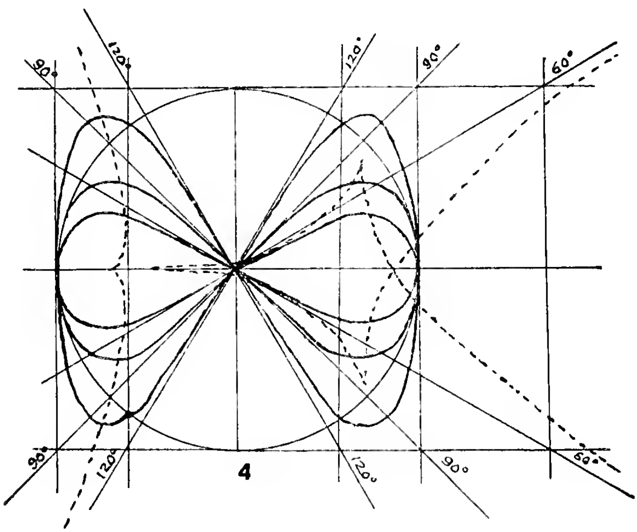

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Fig. 4 Three lemniscates made by my 1910 method for ovals, based on the same governing circle and the same focus or node, but with different directrices, giving them central angles of 60°, 90° and 120°. The normals of each at the node are shown, these being the asymptotes of their evolutes. The evolutes of the two extreme ones are sketched roughly, it being impractical to construct them by a rigorous mathematical method. But only one side of each evolute is drawn, to avoid confusion of too many lines close together. The evolute of the 90° lemniscate is assumed to coincide with the two tangents or normals intersecting at right angles, as explained in the text.

the center of curvature for that point will be beyond the center of the circle, and the points of sharpest curvature will be some disance from the ends, as in some of the Watt's linkage lemniscates already figured. Each half of the evolute will have three cusps, and the assymptotes will diverge at an angle of 60°, as shown in the figure.

Now let us consider the 90° lemniscate, the middle one of the series. It evidently has the same curvature as the circle at its ends (osculating), and has to sharpen its curvature a little to get away from the circle, but soon flattens out so as to have no curvature at the node. The center of curvature for the ends of the lemniscate will be the center of the circle, which is also the focus and node of all these lemniscates. That will necessarily be one point on the evolute; and the tangents to the central lemniscate at the node, which will also be the normals, diverging at 90°, will be the asymptotes of the evolute. And apparently they will constitute the whole evolute.

And somewhere between the 60° and 120° lemniscates there must be others whose evolutes are not the envelopes of their normals, a condition which seems to have hitherto been considered essential for all evolutes.

In my 1956 paper on ovals, etc., I mentioned that a lemniscate could be produced in the steam engine series of curves by putting the marking point on an offset from the driving rod at the cross-head, but I did not draw a figure for that. I have now drawn a series of such lemniscates, attaching the offset at the cross-head, and selecting several equally spaced marking points on it. (Fig. 5.) I have designated twelve equally spaced points on the governing circle by letters, and put the same letters on the corresponding points on each lemniscate, showing how their positions change from one lemniscate to another.

These lemniscates are surprisingly slender, and their axes are not quite straight. But they might be straightened by substituting for the piston rod a long bar pivoted some distance away, making a form of Watt's linkage. The envelope of an infinite series of such lemniscates, like that of the original steam-engine curves (as pointed out in my previous paper), would be two pairs of straight lines, each diverging at a wide angle, and connected by a curve, something like a railroad track.

Endless complications might be brought about by attaching the offset at some other point than the cross-head, between that

and the crankpin or on either side, but I will not go into that at present.

Now for a brief mention of some other lemniscates. The old Century Dictionary, under the head of Lemniscate, illustrates the well-known one of Bernoulli and three others, with irregularly-shaped lobes but still symmetrical. It gives their equations, some of them with odd coefficients, but does not tell how they are constructed.

In some astronomical works one can find mention of the analemma, which is evidently a sort of lemniscate, and looks like a slender figure 8, with unequal lobes. Sometimes one can find one of them on an old globe, usually located in some empty place in the South Pacific Ocean. Dictionaries give three different definitions of that word, only one of which is a curve. It is used by astronomers, and has something to do with the sun being "fast" or "slow" at different seasons, but I have never seen any mention of it in a mathematical text, and still less an equation for it.

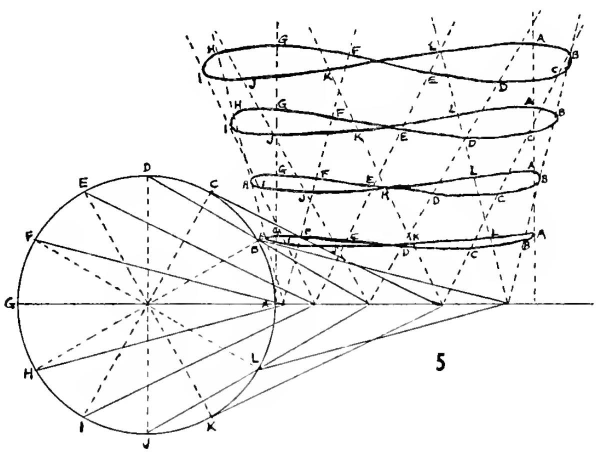

Fig. 5 Four slender lemniscates traced by equally distant points on an offset at the cylinder end (cross-head) of the driving-rod of a steam-engine, as suggested in my 1926 paper. If the series were extended farther the lemniscates would widen a little, but apparently the central angle would never approximate a right angle.

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CONTENTS

THE ROLE OF THE PULP AND PAPER INDUSTRY IN ALABAMA'S PIEDMONT

F. GORDON COMER

Coosa River Newsprint Company
Childersburg, Alabama

Alabama's pulp and paper industry had its beginning in 1929, when the Gulf States Paper Corporation commenced operations near Tuscaloosa. As over the rest of the South, there has followed a steady growth until today there are two roofing mills and seven major pulp and paper mills in the state. The roofing mills—National Gypsum Company and Rubberoid Company—are both located at Mobile. The pulp and paper mills are Hollingsworth and Whitney Division of Scott Paper Company and International Paper Company—both in Mobile, Container Corporation of America at Brewton, Marathan Division of America Can Company at Naheola, Gulf States Paper Corporation at Tuscaloosa and Demopolis, and Coosa River Newsprint Company at Coosa Pines.

Some idea of the industry's rapid growth in Alabama can be gained by comparing the 1938 cut of 375,000 cords of pulpwood with the 1957 cut of more than two million cords.

Wood production in the Piedmont area received a substantial boost when the operation of the new Coosa River Newsprint Company mill increased the cut from 80,000 cords in 1949 to 149,500 cords in 1950 or 11.3 per cent of the state total. The rapid increase which followed reflected both the construction of new mills in the adjacent out-of-state area, and the trend toward concentration of wood production in the areas near the mills which attended the development of rail concentration yards over the state. The 1957 cut of 411,800 cords represented 18.5 per cent of the state's total cut, and Tallapoosa County—maintaining a cut of approximately 90,000 cords for the third consecutive year—placed second in the state.

Heavy shipments to out-of-state mills, which together account for 25 to 30 per cent of the state's total cut, figure prominently in the Piedmont's present production. Three Florida mills—St. Regis Paper Company at Cantonment, International Paper Company at Panama City, and St. Joe Paper Company at Port St. Joe, and two others—Rome Kraft Company at Rome, Georgia, and Bowaters Paper Company at Calhoun, Tennessee—receive regular wood shipments from this area. In addition, other mills draw occasional wood from this area, adding to the overall total. The geographic

location of the Rome and Bowaters mills, plus future shifts in wood procurement areas due to new mill construction will help to maintain this segment of the area's present cut.

Alabama today may be said to have an economy in transition; we are moving from a basically agricultural economy to an industrial-agricultural economy. Coming at a time when the shift from farming has been most pronounced, the pulp and paper industry has not only provided employment for thousands displaced by low farm income, but it has also added a new source of farm income through expanded timber markets. The attendant increase in tree planting, cull hardwood control and other woodland management by small landowners, would never have been attempted were it not for the presence of a stable wood-using industry.

In the Piedmont Area, it is conservatively estimated that more than 2,000 people are actively engaged in the production and delivery of pulpwood to the various mills. Approximately 1,000 more are employed in the nearby Coosa River Newsprint Company mill and this number is still further increased by industry foresters and employees engaged in tree planting and other forestry activities. A good measure of the industry's economic importance to the state may be gained by a consideration of value added by manufacture, which with a figure of $10,101 per worker, the pulp and paper industry places second in the state.

Let us now have a look at some of the industry program and relate them to forestry progress in the Piedmont within the last decade. One of the least publicized—but most basic—has been the industry's role in improving forest fire protection, for without adequate protection the planting of trees and other related activities might never have been carried out.

State Forestry Division records show that a total of 5,497 fires burned 148,832 acres in the Piedmont Counties from 1951 to 1957, or 7.1 per cent of the area's forest acreage. Of this total, control work was undertaken by industry crews on more than 1,000 fires, which burned in aggregate over 40,000 acres. Although fire control by industry is directed primarily at industry-owned land, action is not limited to them, and industry men and equipment have greatly helped to reduce the average size of fire by fast and effective action. The results of this work may be appraised by comparing the 1951 record of 954 fires burning 34,922 acres with the 1957 record of 391 fires which burned only 4,428 acres—the latter giving a percentage burn well below state average for that year. To this a personal note might be added—it has been observed that

the relatively short jump from seedling and sapling to merchantable pulpwood tree has led many people who were formerly indifferent to fire to become leaders in fire suppression and prevention in their communities.

Never before has the public witnessed an educational program equal in scope to that undertaken by the pulp and paper industry since 1950. Demonstrations of good timber cutting practices, films and talks presented before schools and civic groups, the sponsoring of school forests and summer forestry camps, have all served to make people aware of the economic importance of our forests and the opportunities for profitable management. Free pine seedlings have been distributed annually to 4-H and FFA Club members and to small landowners to stimulate interest in tree planting.

It is conservatively estimated that since 1950 industry foresters have given free management advice to private landowners on more than 400,000 acres, representing nearly one-fifth of the area's forest acreage. Selective timber cutting has become almost synonymous with the sale of pulpwood under the industry program of free timber marking to landowners selling timber.

Evidence that the pulp and paper industry has not limited its concern to the timber supply is given in its active participation in wildlife conservation. Cooperative land leases with the State Conservation Department under the Pittman-Robinson Act have been undertaken on a very considerable acreage of industry-owned lands which provide the basis for restocking and management of favored wildlife species. Under this program, deer and turkey have been returned to a vast area of the Piedmont from which they were previously absent. On other areas of industry lands cultural practices are designed to improve the game habitat through the leaving of food and den trees and plantings to increase the food supply. Thus the public is afforded increased opportunities for hunting and other outdoor recreation.

Perhaps the most spectacular development has been the gain in tree planting attendant with the increased pulpwood harvest, Forest tree planting in the Piedmont during the last five years has exceeded the state average, being spurred on by the shift from row cropping and pulp and paper industry leadership in this field. From a modest 1,329,000 trees planted in the 1949-50 season, there has been an advance to 17,420,000 trees for the 1957-58 planting season—14.2 percent of the total planting in the state. Industry planting accounts for an estimated 25 percent of the 54,270,000 planting total since 1949.

Cull hardwood control—a term almost unheard of before the advent of pulp and paper forestry—is being carried out on thousands of acres, adding greatly to the productive capacity of our woodlands. This is especially important in the Piedmont where worthless species have taken over much upland forest area. The increased timber growth in one rotation resulting from such work by the industry in the Piedmont to date would supply the wood needs of one large paper mill for one year.

Not only are these figures impressive because of their size—they are also reassuring in view of the present timber harvest. More important, they are the foundation on which tomorrow's jobs rest. Assured an adequate supply of reasonably-priced raw material the pulp and papeı industry may be expected to expand its operations as the demand for its products increase, thereby adding more jobs in the mills and woods.

At this point I would like to review some of the pulp and paper industry developments within the past decade, and relate them to the outlook for the future.

One of far-reaching effect has been the recent growth in waste utilization by conversion of slabs, edgings and other sawmill wastes into chips for pulp mill consumption. From an estimated southwide production of 175,000 cords of chips in 1954 this has grown at an amazing rate to 1,657,000 cords for 1958—8.4 percent of total wood consumption by pulp and paper mills in the south.

Not only does this have the effect of increasing the total available raw material, but it has been a genuine boom to the lumber industry. Without the additional income from chips, many mills—caught between rising labor and stumpage costs—would not have been able to continue operations.

Alabama's share in chip production came to 159,800 cords for 1957, but since then the number of producing units has more than doubled. In the Piedmont three mills are now producing approximately 18,000 cords of chips per year from slabs and edgings.

In this connection it is interesting to note that the Stanford Report, prepared in 1954 under the sponsorship of the Weyerhaueser Timber Company, forecasts a southwide consumption of 3.5 million cords of chips per year by 1975. At the present rate of development we are more than one million cords ahead of schedule and should arrive at the predicted figure far ahead of this date.

Perhaps the development most noticeable to many of us has been the construction of rail concentration yards with mechanized unloading facilities. At the last count in January of 1957 there were

558 such yards operating in Alabama—12 of which were located in the Piedmont. In addition to stretching the labor supply by reducing unloading time, these yards have relieved the wood producer of car ordering and subsequent risk of demurrage charges, increased the efficiency of rail car handling and are serving as a meeting point for the industry, the wood producer and the landowner.

One trend of interest to the industry and landowner alike has been the increase in pulpwood stumpage prices since 1950. Timber which sold in 1950 for $1.50 to $2.00 per cord is now selling over the Piedmont Area for $5.00 to $6.00 per cord. Even higher prices are reported from such areas near the coastal mills.

Although this is of great advantage to the landowner and has prabably stimulated much interest in timber growing, it should be kept in mind that these increases represent approximately 80 per cent of the increase in the delivered price of wood over the same period. This trend, if continued, could present a serious obstacle to the further development of wood production as a profitable business and could act as a check on further expansion of the industry as a whole. If and when future increases in the delivered price of wood are justified, such increases should be directed toward a more equitable division between the landowner and wood producer.

It is estimated that our per capita consumption of pulp and paper products will increase by 50 per cent during the next 20 years. During the same period our population is expected to increase by 40 million. To supply the increased demands will require additional mill capacity with greatly expanded wood requirements.

By reason of its large forest acreage and its adaptability to short-term timber cropping, the South is the most logical place for pulp and paper expansion to take place. The Stanford Report forecasts a southwide increase in pulpwood production necessary to fill these needs—from 14 million cords in 1952 to 30 million cords in 1975. With consumption estimated at about 20 million cords for 1957, we are slightly ahead of schedule already.

In the Piedmont it is unlikely that new land uses will be found which are more adaptable to its soil and topography than the production of timber. The predicted increase in wood requirements and the possibilities for greatly increased timber yields through good forest management, make a future for this area look indeed bright.

FORT PAYNE CHERT-WARSAW LIMESTONE CONTACT IN LIMESTONE COUNTY, ALABAMA

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The Warsaw limestone and St. Louis limestone compose the Tuscumbia limestone of early Mississippian age in all previous Alabama reports. Butts (1926) suggested that the Warsaw limestone be mapped as a separate formation when enough detailed work has been done to make the Warsaw easily distinguishable from the underlying Fort Payne chert and the overlying St. Louis limestone.

This study is an attempt to work out some criteria for easy recognition of the Fort Payne chert and Warsaw limestone contact.

According to Butts (1926), "The Fort Payne chert is succeeded, with little or no break, by chert-yielding limestone of different character and with different fossils." No fresh-rock outcrops showing the contact were found in Limestone County.

Figure 1 shows the mapped contact of the Fort Payne chert and Warsaw limestone in Limestone County based on the criteria in the summary. Older formations are not shown.

Physiographic Features

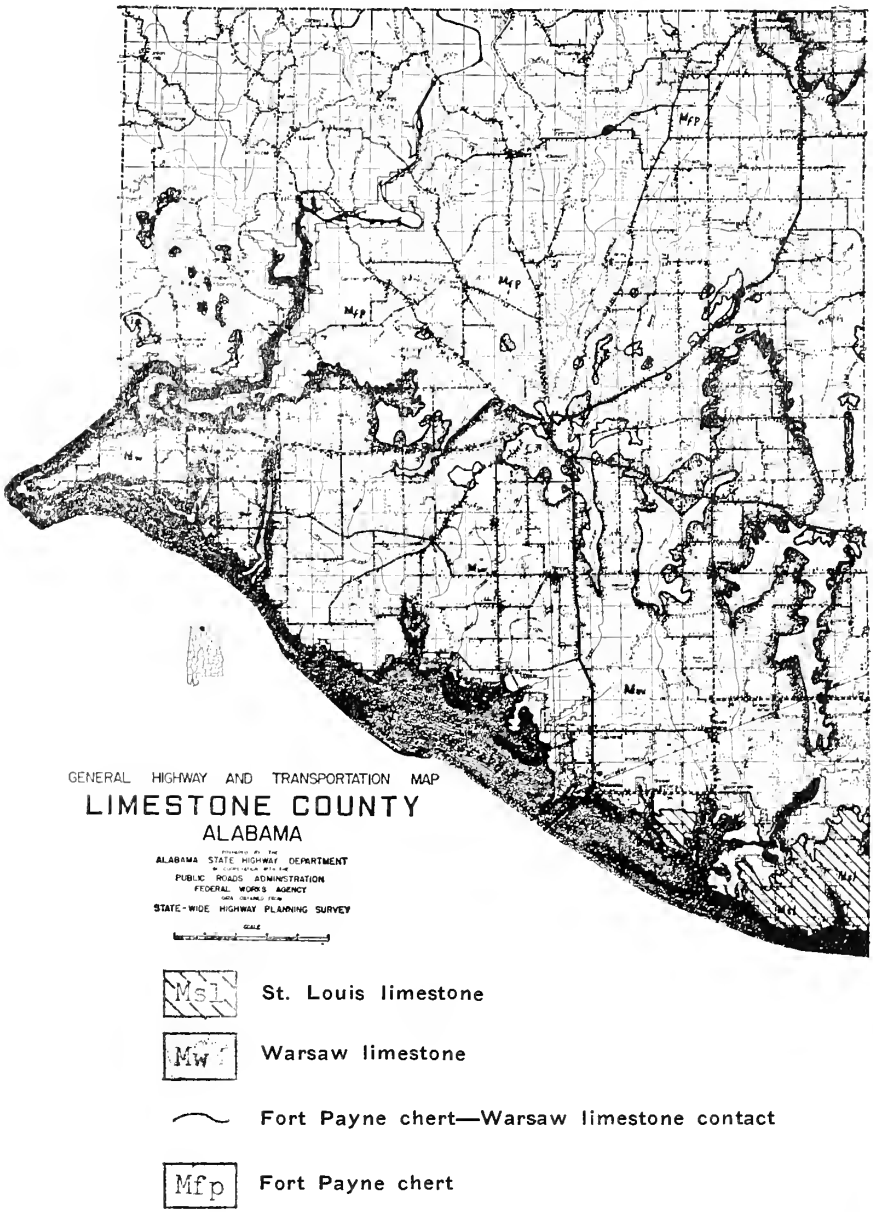
Limestone County is in the extreme north-central part of Alabama in the Tennessee Valley and is in the southern part of the Highland Rim section of the Interior Low Plateau. The outcrop area of the Fort Payne chert and Warsaw limestone lies at the southern extremity of the Nashville dome and is relatively flat except where stream erosion has produced valleys and ridges. The elevation ranges from 550 feet in the southern part to 950 feet in the northern part of the county. The formations dip very gently southward but undulate in places.

Distribution and Lithology

The Fort Payne chert and the Warsaw limestone underlie most of the area of the county. Generally, the Fort Payne is exposed in the northern half of the county except in the valleys of Elk River, Shoal, Sugar, and Limestone Creeks where Ordovician limestone is exposed. The Fort Payne, with a regional dip southward of about 20 feet per mile, also outcrops along the streams in the southern part of the county which drain to the Wheeler Reservoir of the Tennessee River.

The Fort Payne chert is made up of 175 to 200 feet of limestone, shale, and chert; but in some areas the Fort Payne is less than 100 feet. The limestones are generally bluish gray or greenish

gray and very cherty; however, there are beds of rather pure limestone as much as 20 feet thick in some areas. Some of the argillaceous limestone beds weather to brown and green shale. Chert may make up as much as 50 per cent of the fresh rock. The chert beds, usually blue-gray, range in thickness from 1 to 18 inches.



The residuum derived from the Fort Payne chert is in general light yellowish tan. However, in a few areas the residuum is a brownish red much like that derived from the Warsaw limestone. This residuum is derived from locally thickened limestone beds according to McCalley (1896).

Because of the resistance of the chert to erosion, the bottoms of the streams in the area of outcrop are generally hard resistant chert beds which form many small falls and rapids. These resistant beds also form a few steep ridges covered with tan residuum and chert boulders. Many springs issue from the Fort Payne chert. Water wells are frequently drilled or dug to near the top of Chattanooga shale where there are many solution channels.

The Warsaw limestone, about 100 feet thick, underlies most of the southern half of Limestone County. The formation dips south about 20 feet per mile.

The topography above the Warsaw limestone is generally flat or very gently rolling. Bluffs and good exposures of the fresh rock are very rare. Topography was influenced in large part by the easily weathered character of the Warsaw limestone.

At White Spring Cave the Warsaw limestone is a thick-bedded, gray, medium to coarsely crystalline, fossiliferous limestone containing a small amount of chert as small nodules and matrix.

Most of the tracing of the contact of the Fort Payne and Warsaw was done by examining the chert rubble on the surface. When weathered, the Warsaw limestone forms a rich brownish-red, clayey residuum containing rubble of crumbly, matted bryozoan and crinoidal chert. This dark color varies with the moisture content and topography. In a few flat-lying areas, where drainage is mostly downward and not runoff, most of this rich brownish-red color has been leached and the residuum is similar to the yellowish-tan residuum of the Fort Payne.

Paleontology

Large crinoid stem plates, large brachiopods and large cup corals are characteristic of the Fort Payne chert. The following fossils were identified from outcrops in Limestone County:

Bryozoans
- *Bactropora simplex*
- *Ptiloporo cylindracea*

Brachiopods
- *Allorhynchus heteropsis*
- *Schizophoria swallovi?*
- **Spirifer grimesi*

* guide fossils (Weller and others, 1948)

**Spirifer logani*
Spirifer keokuk
Schuchertella desiderata
Torynifer pseudolineata
**Orthotetes keokuk*
Athyris lamellosa

Corals
Neozaphrentis tenella?
Zaphrentis sp.
Triplophyllum spinulosum
Hadrophyllum ovale

Crinoids
Platycrinites sp.
Numerous unidentified large stem plates

Trilobites
Griffithites sp.

Graptolites
Dictyonema sp.

Matted bryozoans, small crinoid fragments and stem plates and small brachiopods in the Warsaw limestone are characteristic. The following fossils were identified from the chert and limestone of the Warsaw limestone in Limestone County:

Bryozoans
Hemitrypa proutana
Polypora sp.
Fenestralia sancti ludovici
Cyclopora fungia
Dichotrypa flabellum?
Bactropora simplex
Fenestrellina tenax
Worthenopora spinosa

Brachiopods
Linoproductus chao?
Linoproductus sp.
Cyrtina sp.
Camarotoechia mutata
Dimegelasma sp.
**Brachythyris subcardiformis*

Corals
Amplexus yandelli?

Crinoids
Batocrinus iscosadactylus
Echinocrinus shumardiana
Numerous unidentified small stem plates

Trilobites
Griffithites sp.

Blastoids
Pentremites conoideus

Gastropods
Lepetopsis levetti?

SUMMARY

CRITERIA FOR RECOGNITION OF THE FORT PAYNE CHERT AND WARSAW LIMESTONE CONTACT

Weathered Exposures

Fort Payne chert	Warsaw limestone
1. Chert very resistant to weathering.	1. Chert weathers readily to crumbly rubble.
2. Chert is usually bedded and fractured. Slumping of beds common. Some green and brown shale interbedded with chert.	2. Chert usually occurs as unbedded fragments which break easily.
3. Outcrop area strewn with fragments of tan and white chert in a yellowish-tan residuum.	3. Outcrop area has minor amount of iron-stained tan chert in brownish-red residuum.
4. Chert forms steep ridges and bluffs along major creeks. Other areas rolling.	4. Gently rolling red hills.
5. Large crinoid stem plates, large brachiopods and large cup corals characteristic. Some chert beds may be 50 per cent of the rock.	5. Matted bryozoans, small crinoid stem plates and small brachiopods characteristic of all chert.

Fresh Exposures

Fort Payne chert	Warsaw limestone
6. Alternating blue-gray chert beds and nodules in limestone. Chert may be 50 per cent of the rock.	6. Gray chert nodules less abundant in limestone.
7. Chert beds up to 18 inches thick.	7. Chert nodules up to 8 inches thick.
8. Bluish-gray to green limestone varies from fine-grained and argillaceous to coarse-grained with abundant large crinoid stem plates.	8. Gray limestone is principally medium to coarse grained with some small crinoid stem plates.
9. Thickness 175-200 feet, but in some areas less than 100 feet. General dip south 20 feet per mile.	9. Thickness 90-100 feet, dipping south about 20 feet per mile.
10. Forms many small rapids in creeks.	10. Few rapids formed in creeks.

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SOUTHERN FUSIFORM RUST ON SLASH PINE PLANTED IN THE ALABAMA PIEDMONT

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Southern fusiform rust, *Cronartium fusiforme*, (A. and K.) Hedge and Hunt, appears on limbs and stems of slash, loblolly and longleaf pines. The long, spindle-shaped swellings and cankers are the observable symptoms of this disease. Infection usually takes place on new needles or on tender, new stem and branch tips. The incidence of southern fusiform rust depends on several climatic, physiographic, genetic, and cultural factors. The occurrence of new infections varies greatly from year to year[3].

Some pine seedlings that become infected in tree nurseries are culled, but a certain number of diseased seedlings escape detection and are outplanted. The limb infections occur after trees have been established in field plantings. The limb infections do not kill trees, but they may progressively develop into stem infections unless the branches are pruned before fungus mycelia reach the main stem. The stem infections may kill some trees or create a point of weakness at which they might be broken by winds. In tree utilization, only the stems are converted into commercial products. Therefore, limb infections do not affect the yield or the quality of forest products. The stem infections, though not a factor in the yield and quality of pulpwood, produce defects in logs that are to be converted into lumber. Therefore, stem cankers on trees of large diameter affect yield and quality of manufactured forest products.

Slash and loblolly pines are particularly susceptible to the southern fusiform rust[4]. Goggans[1], in a study of slash and loblolly pine plantations in the Alabama Piedmont, found no important difference between the amount of infection on slash and loblolly pine in pure plantations. The great popularity of slash pine for forest planting in the South makes it important to know to what extent the southern fusiform rust infects this species of pine and how much damage can be expected to result from this disease.

A series of observations was begun in 1947 in a slash pine plantation on the Forestry Unit in Coosa County to determine tree mortality, incidence and distribution of fusiform rust on tree stems, and effect of pulpwood thinning on the removal of diseased trees. The forest is located in a typical woodlot area of the Alabama Piedmont. The topography is rolling, the soils are shallow and rocky. The best sites occur in narrow bottoms with alluvial deposits.

A slash pine plantation was established in the winter of 1940 in an abandoned field lying along a narrow terrace near a stream. It extended for about a quarter of a mile along the stream in a strip varying in width from 2 to 5 chains. The trees were planted at a 6x6-foot spacing. The planting site appeared to be of uniform quality. The plantation was sampled by means of three permanent plots with one hundred planted trees in each lot. Southern fusiform rust was abundantly present on loblolly pines growing in a woodlot surrounding the planted field. The alternate host, oak, was also plentiful in the woodlot.

Trees were first inspected in 1947, 7 years after planting. At that time 88 per cent of the trees were living (Table 1), an excellent survival rate. Trees were again examined 11 years and 16 years after planting, in 1951 and 1956 respectively. In 1956, 72 per cent of the trees were living, and their average diameter was 6.0 inches. The height of dominants was 55 feet. The basal area was 172 square feet per acre.

Immediately following the last examination, the plantation was marked to be thinned in a pulpwood cutting operation. The trees without rust infection or other defects, such as forking or crook, were favored to be left. A small number of diseased trees below merchantable size were not marked. In consideration of the spacing of the residual stand, some trees free of defects were marked to be cut. After the marked trees were cut, 520 trees per acre were left. Basal area of the trees left was 107 square feet per acre. In the thinning operation 38 per cent of the basal area was removed.

At each inspection symptoms of infection by the southern fusiform rust were recorded (Table 2) according to height above the ground and position on the tree stem, limb-to-stem, or limb. Tree diameters were measured and mortality was recorded. Trees removed in the 1956 thinning operation were recorded after the marking was completed.

The percentage of trees with observed symptoms of infection was nearly the same at 11 and at 16 years after planting. The incidence of rust infection was 57 per cent, considerably above the average of 25 per cent found by Goggans[1] in 21 slash pine plantations in the Alabama Piedmont.

In spite of the high incidence of rust, there were 375 trees per acre free of rust infection 16 years after planting. After the first thinning, made at that time, 295 apparently healthy trees remained per acre. The number of trees with infections was reduced to 225 per acre, or 43 per cent in the remaining stand. In the future thinnings infected trees will, of course, be marked much more heavily

TABLE 1—Tree mortality and southern fusiform rust infections on slash pine in a plantation in the Alabama Piedmont.

Condition of trees and time of inspection	Plot No. 1	No. 2	No. 3	All Plots	On Acre	
	Number of trees				Per cent	Number
MORTALITY						
Dead and missing in 1947	7	12	16	35	11.7	141
Dead in 1951 with stem infections observed in 1947	3	5	6	14	4.7	57
Dead in 1956 with stem infections observed in 1947 and 1951	9	9	12	30	10.0	121
Dead in 1956 free of infections at two previous inspections		5	1	6	2.0	24
SUBTOTAL	19	31	35	85	28.3	343
INFECTED TREES						
Living in 1956 with stem infections observed in 1947, 1951 or 1956	40	22	31	93	31.0	375
Living in 1956 with limb-stem infections higher than 4 feet above the ground; limb-stem or limb infections observed in 1951.	5	5	3	13	4.3	53
Living in 1956 with limb infections higher than 4 feet above the ground first observed in 1951.	4	5	2	11	3.7	44
Living in 1956 with limb infections higher than 4 feet above the ground observed in 1956.	1	2	2	5	1.7	20
SUBTOTAL	50	34	38	122	40.7	492
HEALTHY TREES						
Living in 1956 free of observed infections in 1947, 1951 and 1956.	31	35	27	93	31.0	375
TOTAL STAND	100	100	100	300	100.0	1210

than healthy trees. There are enough trees free of rust infection to provide about 75 per cent of the number of trees conservatively estimated, for an adequate stand when it first reaches sawlog sizes.

Further examination of Table 2 shows that many rust-infected trees had only limb infections in 1956. This type of infection does not produce detrimental effects on utilization. Only 18.7 per cent of the living trees in this state of infection were cut for pulpwood. There were 53 such trees left per acre. Eighteen trees on the plots had stem cankers at the base and no other infections. One-half of these were left uncut. If they remain until they are cut for sawlogs, the defects from the rust canker will be left in the stump. The 36 trees per acre left in this group and the 53 trees with limb infections only made up 17.1 per cent of the stand remaining after the first pulpwood thinning.

There were five trees with limb infections that apparently later progressed into limb-to-stem infections (Table 2). The 38 trees with limb-to-stem infections recorded in 1947 apparently existed as limb infections before that time. If these trees with infected branches had been pruned before 1947, a practice suggested by Lamb and Sleeth [2]. many of the branch infections would have been prevented from developing into stem infections. A timely pruning operation theoretically would have added as much as 20 per cent more healthy trees to the stand in 1956. If only half of them were retained after thinning, the number of healthy trees per acre after the pulpwood cut would have been augmented by 52. The proportion of infected trees in the residual stand would have been reduced from 43 to 33 per cent.

The 59 trees recorded in 1956 with multiple stem infections also undoubtedly could have been reduced in number by pruning. This group of trees was quite important because, if left to grow to sawlog size it would suffer the heaviest losses in volume yield and the greatest degrade in quality. The cankers would be present on one or several logs produced from each of such trees. Only 32.2 per cent of these trees were left after the first thinning. On a per acre basis, 76 trees with multiple stem infections were left in the residual stand. They constituted 14.6 per cent of the remaining trees. In future thinnings these trees will likely be marked for removal, following the pattern already evident in the first marking. By the time the plantation reaches sawlog size, there will be 250 to 300 trees per acre in the stand, and only a few, if any, trees with multiple stem cankers will remain. Damage to the yield of the stand caused by fusiform rust on stems with many cankers will become negligible.

From the observations made it can be concluded that in a slash

TABLE 2—Nine-year record of observed symptoms of infection by Southern fusiform rust on slash pine planted in the Alabama Piedmont.

Type of Infection	Location above the ground	Year of Inspection 1947	1951	1956	Results of pulpwood cutting in 1956: Trees Cut	Trees Left on plots		Trees Left on acre
	Feet	Number of Trees					Per Cent	Number
A. Multiple infections with at least one stem infection	0-1	11	22	22	16	6	27.3	24
	1-2	5	13	13	9	4	30.8	16
	2-4	4	7	7	6	1	14.3	4
	above 4		8	17	9	8	47.0	32
SUBTOTAL		20	50	59	40	19	32,2	76
B. One stem infection only	0-1	5	18	18	9	9	50.0	36
	1-2		6	6	4	2	33.3	8
	2-4		2	2	2			
	above 4		5	8	3	5	62.5	20
SUBTOTAL		5	31	34	18	16	47.1	64
C. Limb-to-stem infection and no stem infection	0-1	22						
	1-2	10						
	2-4	4						
	above 4	2	3	13	5	8	61.5	32
SUBTOTAL		38	3	13	5	8	61.5	32
D. Limb infection only and no stem or limb-to-stem infections	0-1							
	1-2	4						
	2-4	1						
	above 4		24	16	3	13	81.3	53
SUBTOTAL		5	24	16	3	13	81.3	53
E. No infection at a given year but infected at subsequent inspections		54	14					
F. Trees with no observed symptoms of infection, apparently healthy.		93	93	93	20	73	78.5	295
TOTAL		215	215	215	86	129	60.0	520

pine plantation, even one with a very heavy incidence of southern fusiform rust, a relatively small loss in yield can be expected when the stand reaches sawlog size. This is predicated on removal of diseased trees in several thinning operations before the trees grow to sawlog size. In marketing, the practice of leaving healthy trees and those with limb infections only should be followed to a limit consistent with silvicultural considerations as to spacing and stand density.

Further gains can be made in approaching a canker-free stand by removing branch infections in pruning before they can progress into the stems. Even without this practice, which should be carried out at an early stand age to add to the value of the sawlogs, an adequate number of healthy trees are retained. Healthy trees will constitute a substantial proportion of the stand when it reaches sawlog size, and the number of trees with multiple stem infections will become negligible.

If this is true for plantations with a heavy incidence of fusiform rust and if they can be successfully managed for saw timber production, the presence of fusiform rust in plantations with average rate of infection should be considered as a negligible factor affecting future yields.

* * * *

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THE DIELECTRIC CONSTANT VALUES FOR SOME ALPHA SUBSTITUTED KETONES*

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In the research involving ultraviolet absorption spectra of ketones to study inductive and stearic effect of substituted groups on the alpha carbon, Mountcastle[3] obtained and prepared a number of unusual ketones. For some of these ketones, in addition to there being no absorption data, there were no dielectric constant values recorded in the literature.

This paper reports the dielectric constant value for five of these alpha substituted ketones at 25°C.

MATERIALS AND EQUIPMENT—

Purification.—The stable ketones and other non-chloro compounds were distilled with a Podbielniak #3300 Microanalyzer equipped with a two foot column. The chloroacetones were distilled at reduced pressure and in a column using glass packing. Two physical constants refractive index and boiling point, were used as a means of checking purity for the stable compounds. For the unstable compounds only refractive index was used.

Equipment.—A non-inductive type cell was constructed similar in design to those described by Conner, Clark and Smythe[1], and by Critchfield[2]. This unit included a built-in water jacket for temperature control and a teflon plug or base as the insulator between the two electrodes, *Figure 1.* The inner metal parts were heavily plated with gold to withstand action of any corrosive chemicals. This type of cell was used since no lead inductance corrections were necessary and it was self shielding.

The General Radio Type 821-A Twin-T Impedance Measuring Circuit was used for all capacitance measurements. A Measurements Corporation Standard Signal Generator served as the frequency input to the bridge and a Hallicrafters SX-62 receiver was used as the detector.

EXPERIMENTAL

By the application of Gauss's Law to the cell it can be shown that

$$C = Ak' + D \qquad (1)$$

where A and D are constants. Thus capacitance versus dielectric constant should be a straight line.

This cell was calibrated with liquids of known dielectric con-

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stant at frequencies of 3, 5, 15, and 25 mc. and at the temperature of $25.00 + 0.02°$. Benzene, 1, 2-dichloroethane, ethanol, and methanol were used since they show no frequency dispersion of dielectric constant in the frequency range of this work. Air with the dielectric constant value of one was also used. The capacitance for each substance in the cell was measured with the bridge. These capacitance readings at each frequency were corrected for drum variation of the calibrated condenser and for residual impedance based on the manufacturers' charts. The corrected capacitance values were plotted against the dielectric values for the material as given in N.B.S. Circular 514[5]. The calibration points produced straight lines at each frequency.

For the equation

$$C_x = \frac{dc}{dk} k_x + C_{k=0} \qquad (2)$$

obtained from equation 1, the values for dc/dk Ck=0 were determined so the dielectric constant values could also be calculated.

As a check on the accuracy of the calibration, the dielectric constants were determined for acetone and methyl ethyl ketone and compared with the literature values, Table 1.

Table 1. Experimental and Literature Values[5] at 25°.

	Experimental	Literature
Acetone	20.71	20.70
Methyl ethyl ketone	18.08	18.07

RESULTS

The dielectric constants for five alpha substituted ketones were measured at each frequency. Since the value for each ketone was constant at each frequency, the static values are listed in Table II.

Table II. Static Dielectric Constants at 25°.

	Experimental	Literature
Methyl isopropyl ketone	16.11	
Diisopropyl ketone	15.75	15.8* (4)
Monochloroacetone	29.04	
Pentachloroacetone	9.761	
Hexachloroacetone	3.835	

*estimated from graph and at 20° C.

The errors for the values listed in Table II, as calculated from the limits of error information for the impedance measuring circuit, are from ±2.0% for the hexachloroacetone to ±0.6% for the monochloroacetone.

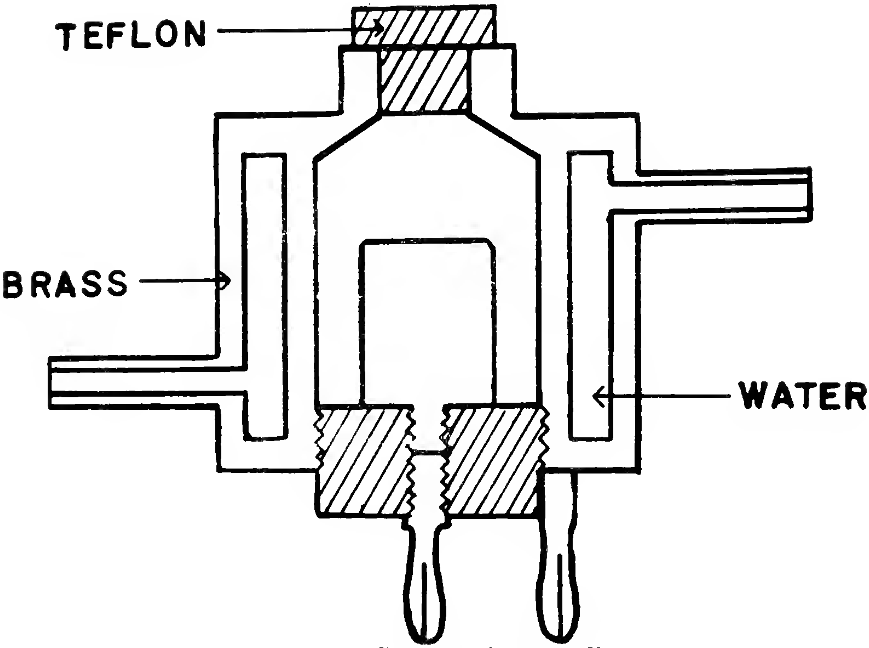

Figure 1. Cross Section of Cell

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SOME STATISTICAL INDICES OF CULTURE

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Many attempts have been made to measure the civilization, or culture, of different countries, states, cities, racial groups, etc. Some "yardsticks" have been based on wealth and the prevalence of certain conveniences, luxuries, etc., some on education, and some on health, as indicated by infant mortality, longevity, etc. But no measure, or index, is perfectly satisfactory, and no two give

the various population areas or groups the same rank. It is hard to give an exact definition of culture, anyway.

Some indices that are very good for comparing different areas or groups at the same time are not so good for comparing the same ones at different times. For example, such indices as urban population, per capita wealth or income, birth and death and infant mortality rates, may change markedly for the better from one generation to another, without much change in real culture.

One of the earliest attempts of this sort, to compare different parts of the United States, that has come to my notice was "The distribution of ability in the United States," by Senator Henry Cabot Lodge of Massachusetts, in the Century magazine for September, 1891. That was before we had any "Who's Who in America," and it was based on 14,243 native whites, 1,271 foreign whites, and 62 negroes, listed in Appleton's Cyclopaedia of American Biography, a six-volume work published in New York in 1888-1889 (with a supplementary volume in 1901). (The work also listed a number of American Indians, early Mexican chiefs, and distinguished foreigners who never visited this country, but Mr. Lodge did not explain what he did with those.) The number of noted persons born in each state could not be compared closely with the population of the several states, for some of the states had increased much more rapidly in population than others. In fact fifty years earlier most of our western states were not on the map at all, while most of the eastern states had civilization well advanced. And even in the original 13 states, large states like New York and Virginia had naturally produced more notables than small states like Rhode Island and Delaware. But making what allowances he could for differences in population, the author thought Connecticut had produced more notables in proportion to population than any other state.

He also classified his noted persons by racial or national origin, occupations, etc., and brought out some interesting variations in that way. People of English stock predominated, but the Huguenots and other French made a much better showing in proportion to their numbers than the Germans, in the author's estimation.

In the next decade Prof. J. McKeen Cattell, psychologist, of Columbia University, compared the number of "starred" (prominent) scientists in the United States geographically in the same way, and reported the results in three numbers of Science in November and December, 1906, and in the back pages of the second edition of his "American Men of Science," published in 1910. That was

an interesting pioneer study, but it involved at least one statistical error, which will be mentioned farther on.

Prof. Mark Jefferson, of Ypsilanti, Michigan, claimed to have been the first to compare the civilization of different countries statistically, in an article "Culture of the nations," in the Bulletin of the American Geographical Society (New York), 43:241-265. 1911.

The first important book on the subject that has come to my notice is Ellsworth Huntington's "Civilization and Climate," 1914. That covered most of the world, and for rating different countries the author depended largely on the opinions of anthropologists. For rating the several states of the Union he used a variety of census statistics, some more significant than others. He made no use of intelligence tests, which were then in their infancy, and imperfect, and even yet we do not have sufficiently detailed and accurate ones to enable us to make valid comparisons between different states, or smaller units. But if we had, they should be very useful, for the intelligence of a given community does not seem to change much from one generation to another, unless by the migration in or out of superior or inferior people.

Intelligence tests of a sort were applied to all United States soldiers in the first World War, and they showed significant differences between officers and privates, whites and Negroes, etc., but were not published in sufficient detail to show differences between states. (See Lothrop Stoddard, "The Revolt Against Civilization," 1922, Chapter 2: E. M. East, "Mankind at the Crossroads," 1923, Chapter 5.)

In the Scientific Monthly for March, 1920, I proposed a system of measuring civilization by means of occupation groups, based on "Who's Who in America" and a few city directories. While directing the Florida state census of 1925 I tried to apply that method to the whole population; but it proved too confusing to the enumerators, who had had no advance notice of it, and the results were never tabulated.

In the Geographical Review for October, 1929, Prof. Mark Jefferson made a study of inventiveness, comparing different countries according to the number of patents issued. Incidentally, he put Switzerland at the top, the United States above the middle, and Russia near the bottom; but perhaps later figures would change the rank. Such data are available for each state in the U.S. at various times, and some of them have been used in the table farther on.

In the Scientific Monthly for February, 1930, I compared sev-

eral typical American college towns by means of family composition, etc., and showed that they all have a larger number of women per family than the average. And this is one of the indices used in the correlation table farther on.

In three issues of the American Mercury, September to November, 1931, Charles Angoff and H. L. Mencken discussed "Which is the worst American state," presenting statistics of various kinds for each state, and giving them composite ratings. But most of their measures dealt with wealth and things closely correlated with it, rather than true culture; with the result that the state that they rated highest when all their indices were combined is near the bottom in such matters as alcoholism and divorce (topics which they cynically sidestepped).

About 1932 a few magazines with nation-wide circulation published details of their circulation by states, and even by counties, showing wide and interesting variations in the ratio of magazine readers to population. But of course no separation of races was possible in such statistics, so that the figures did not mean much for the South.

Early in 1939 Prof. E. L. Thorndike of Teachers' College, New York, a psychologist, published a small book entitled "Your City," in which he made statistical comparisons between all our states and many cities. And about the end of the same year he published a variation of it entitled "American cities and states: variation and correlation in institutions, activities, and the personal qualities of the residents," in Annals of the New York Academy of Sciences, 39:213-298. (Dec. 22, 1939.) But his indices were too heavily weighted with economic matters, and told little about intelligence and still less about morals.

I have had a few studies of this sort in previous volumes of our Journal. At the Troy meeting, in 1936, I discussed "Some acid tests for states," and the significance of health, illiteracy, "Who's Who" people, inventors, college students, prisoners, bachelors, prohibition vote, suicide, etc. In Montgomery the next year I discussed the significance of bachelors and spinsters, especially the latter (of which more farther on). At the Birmingham meeting in 1944 I discussed "Women per family as an index of culture," and at another meeting in the same city three years later I presented some 1940 educational statistics for the United States, showing for each state the percentage of adults who had never been to school and those who had been through college, separating whites and Negroes.

In the present study I have used only, or mainly, indices that should not vary much from one generation to another, omitting age distribution, health, wealth, education, etc., which might be useful for comparing diferent areas at any one time, but have changed rapidly in the past and may do so in the future. But at the same time there have been some secular changes that seem significant, and those have been shown by statistics of some indices for two or more censuses.

I have also omitted all consideration of morality, because that is difficult to measure, and also because it does not seem to be closely correlated with culture in the sense in which I am using the term. For example, throughout the United States, if not the rest of the world, the most prosperous and best educated people, as well as colleges, libraries, museums, art galleries, etc., are chiefly concentrated in cities. But at the same time, cities practically always have more crime, divorce, intemperance, etc., in proportion to population than neighboring rural districts.

Professional statisticians like to make correlations of different traits of the same area or group by means of correlation coefficients, which mean very little to the uninitiated. My favorite method is one much easier to understand. First I take the various states, counties, or whatever units I am comparing, and find the ratio of each in whatever trait I am comparing others with, be it density of population, race composition, sex ratio, per cent of adults, or what not, and arrange them in order of rank. Then I divide them into a convenient number of equal groups, say four or ten, and prepare a table, with columns for the other traits that are to be compared with the primary one.

When the table is filled out I add the ratios for each quartile, or whatever division is used, and get the unweighted averages for each column. (Greater precision might be attained by true averages, but that would take much longer, and unweighted averages should show the correlations nearly as well.) The primary rating will of course grade pretty uniformly from the highest to the lowest group. And any other trait that shows a fairly uniform gradation, either up or down, from quartile to quartile, is assumed to be correlated. Of course the smaller the divisions, and the more uniform the gradation, the more perfect is the correlation.

To take a simple example, suppose we wish to correlate density of population with urban percentage. If we arrange the states in order of density of population and divide them into quartiles, we will find that the highest group has the largest percentage of urban

population, which would be expected. But the correlation is not exact, for Nevada, with about two inhabitants per square mile, has a larger urban percentage than Arkansas or Mississippi, where the population is several times as dense.

And if we use quartiles, and find that one of the intermediate groups is out of line with the extremes in some trait, the significance of that trait as a good index may well be questioned.

For the present study, for the sake of uniformity and simplicity, I have divided the states into four groups of 12 each. The District of Columbia is omitted because it is not a state, and is all city anyway; and Alaska and Hawaii because they were not states at the time this study was made and are abnormal in several ways. If they were included, the District of Columbia would be one extreme in density of population and a few other things, and Alaska the other.

All my ratings are based on the white population only, as far as possible; for to include all races, as is commonly done by those who like to give the South a low rating, would cause needless complications. (One would hardly rate South Africa on the basis of aggregate population, for the whites there are about as civilized as those in Europe, where their ancestors came from, while the blacks, who greatly outnumber them, are still pretty primitive.)

In the present study I have based my primary rating on the ratio of natives of each state listed in "Who's Who in America" to total white natives of that state as given in the U.S. census tables for the corresponding years. (There are a few Negroes in "Who's Who," probably less than one per cent of the total, but I have made due allowance for them.) Up to 1936 each volume of "Who's Who" contained a table showing the number of natives and of residents of each state listed in it. That was then discontinued, without explanation, but a possible reason might have been objections from the states that were losing rank. One could circumvent that by making his own count in each later volume, but that would be a tedious task, and hard on the eyes of an old person, on account of the fine print.

I have also tabulated the residents of each state listed in "Who's Who." That too correlates pretty well with culture, for the most cultured states would naturally have the largest proportion of noted persons living in them. Perhaps we should say that the statistics based on nativity indicate the culture of half a century earlier, for the average "Who's Who" person seems to be about 55 years old,

while the statistics of residents indicate the culture of the present time.

These statistics are based on three editions of "Who's Who," those for 1910, 1920 and 1930, and the primary rating is that of natives in 1920, the middle of that period. For natives some 1936 figures are added to show trends, but those are less reliable, for the number of natives of each state living in the United States in that year had to be estimated.

Some of the "low" group of states made a much better showing in natives in 1930 than in 1910, presumably indicating that they had much more culture around 1875 than they did around 1855, when some of them were still territories, and the vast majority of their population was still on farms or ranches, or in mining camps. To illustrate this trend I have put at the head of the table the average date of admission to the Union of each group. This is significant, for the miners, cowboys and farmers in the territories were not likely to be fathers of notables. West Virginia, admitted in 1863, is an exception, for it never was a territory, and became a state by a Civil War separation. But omitting it would not change the average for its group much.

It should be observed here that "Who's Who" lists both statesmen and scientists, and many other kinds of people. Scientists are much more likely to be born in cities than on farms, and statesmen vice versa, for a rural environment is much more conducive than an urban one to self-reliance, or used to be at least. Statesmen used to like to brag about being born in log cabins, but that day is past, with the farmers rapidly becoming "citified" with automobiles, electricity, etc., and at the same time losing their self-reliance, with the government meddling more and more in their affairs.

We can get some indication of variations in this respect in different parts of the country from the occupation statistics in Lodge's article cited on the first page. Among the natives of New England counted by him (taking the occupations in the same order as in the U.S. aggregate, and omitting some smaller categories), 17.7% were clergymen, 21.6% statesmen and soldiers, 18.1% writers, 5.87% physicians, 5.60% educators, and 4.13% scientists. The corresponding figures for the typical or "Deep" South (North Carolina to Florida and Mississippi, bordering the coast) were 11.3% clergymen, 47.3% statesmen and soldiers, 9.5% writers, 6.40% physicians, 1.96% educators, and 2.37% scientists. These figures would of course change from one generation to another, and correspond-

ing ones for the 20th century, such as might be dug out of "Who's Who in America," might be quite different.

The table farther on shows a marked concentration of native scientists in the most cultured states. But if we had similar data for statesmen (which might be dug out of "Who's Who" if one had suficient time and patience) the contrasts would doubtless be much less, and might even be reversed.

The statistics of "starred" (or prominent) scientists are taken from Prof. Cattell's study of 1906, cited on the second page. In that he figured that the average American scientist was about 45 years old, and compared the number of scientists born in each state with the population of that state in 1860. He admitted that the ages of scientists were not uniformly distributed, but thought the irregularities would smooth out pretty well. Not having had much experience with census statistics, he overlooked the fact that he could have gotten the number of natives of each state all the way back to 1850, and compared the number of native scientists with them, regardless of age.

His method was fair enough for most states, but happened to give Nebraska an abnormally high rating. For he had only two "starred" Nebraskans, and I happened to know that they were both botanists, one born in 1870 and the other in 1874. So the average date of their birth was 1872, at which time Nebraska must have had about 140,000 inhabitants, as compared with 28,841 in 1860, the date used by Cattell. He gave Nebraska 69.3 scientists per million, and my method 3.3. He overrated a few other western states in the same way, but I cannot check up on that without knowing what individuals were involved.

Cattell also indicated the number and ratio of resident scientists in each state, and I have tabulated those too, with results quite different from those for natives. For scientists are pretty migratory people, and are likely to concentrate in states where educational and research institutions are most numerous. (In that respect, the District of Columbia far outranked all the states.)

Scientist and inventor are not synonymous, but science and invention have much in common, and the next two lines of the table give the number of patents issued to residents of the four groups of states, and the whole country, per million inhabitants, for two periods about a generation apart, 1906-1908 and 1934-1936. The gradation is still fairly regular each time, but the decline from high to low was sharper in the later period than in the earlier, instead of less as in the case of the "Who's Who" natives.

The per cent of population urban is not necessarily a measure of culture, for it has increased pretty rapidly in nearly every state, without any real increase in the quality of population, but it affords such a regular gradation between quartiles that the figures for 1910, 1920 and 1930 are presented. Figures for all races combined have been used, to save time, but those for whites only would not differ much.

The census of 1940 gave us for the first time the number of houses in each state and county that were built before 1860, and in various later periods. And comparing that with the total number of dwellings reported in 1860 should be a pretty good measure of culture; for people in primitive tribes usually live in flimsy huts, and those in frontier communities often in log cabins, sod houses, and other cheap buildings that are not intended to be permanent, while those in old-settled communities are more likely to have substantial houses of brick or stone, and take good care of them. I have no figures on old houses in other countries, but they must be much commoner in Europe than here, and less so in South America and Africa. So I have used statistics of this sort in the correlation table. (They can often be used also to show marked differences between different regions in the same state.)

Reverting now to population statistics, one of the best indices of culture seems to be the average age at first marriage. For in spite of many individual exceptions that one can find among his acquaintances, intelligence and the mating instinct in the human race seem to be inversely related. Until the days of the "welfare state," beginning about 25 years ago, when the government began trying to relieve all citizens of responsibility as far as possible, marriage usually meant the end of education; and scientists especially used to postpone marriage until they had finished their college and graduate work, and established themselves in a position where they could save up some money.

We do not yet have satisfactory data on average age at marriage for all states, but for every census since 1890 we can get the proportion of either sex married in the 15-20-year age group, separating white and colored, in every state and large city. That should be a pretty good index of the age at marriage, and I used it in a talk on such trends, at our 1958 meeting (published in the last number of our Journal for that year). Figures for females only are used here, for comparatively few white males married before the age of 20, until quite recently.

Figures are here given only for three different census years,

1910, 1920 and 1930, so as to be comparable with the "Who's Who" years already referred to. We here observe much the same gradations from high to low as in the other indices, and comparatively little change from 1910 to 1930. (But the figures rose pretty sharply between 1940 and 1950, not only for the whole United States, as I pointed out last year, but for every state, and some foreign countries.)

People who are more interested in brains than in sex not only marry later than the average, but a considerable proportion of them never marry at all. Here again the figures for females are more significant than those for males, for in some of our western states, especially in earlier years, and in Alaska today, there is such an excess of men that many of them cannot find wives; and that of course is no indication of culture.

The table gives the proportion of white females over 45 years old who were unmarried in 1910, 1920 and 1930, and shows much the same gradation from the high to the low group of states as the other indices, but some increase in each group in the 20-year period, probably due largely to a decreasing excess of males. (That reached a peak, in the white population of the United States, about 1910, but since about 1945 females have outnumbered males, for the first time in our history.)

It is interesting to note here that spinsters are common in northwestern Europe, rare in Asia and Africa, and indeterminate in Latin America; which corresponds pretty well with what we know of the culture of those areas.

The number of women per family correlates pretty well with the marital condition figures, and has the advantage of being available as far back as 1850, while marital condition statistics go back only to 1890; except that a few cities, such as Boston and Charleston, had such records even before 1850. (But the family statistics for 1850 and 1860 are for the free population only, and those of 1870 and 1880 do not separate races.)

If it was customary for everyone to marry at 21, there would be just about one man and one woman per family; but any one who remains single for awhile after passing 21 then becomes an extra adult in some family, either that of his (or her) parents, or in a boarding-house elsewhere. My 1930 study of college towns, previously referred to, showed a pretty high proportion of women per family in them, and my 1944 study of women per family showed Boston in 1850 leading all cities for which I had such data. The

present study shows a pretty good gradation from the high to the low group of states in 1910, but not so good in 1940.

We would hardly look upon insanity as a measure of culture, but at any one time it seems to be pretty well correlated with culture, geographically. But its apparent rapid increase through the years, and the present widespread worry about mental health, can hardly be regarded as indicating increasing culture. We have some figures on it for most censuses since 1850, and Gen. Francis A. Walker, who directed the censuses of 1870 and 1880, commented on its apparent increase in the intervening decade, and thought it must be due to increasing attention being given to the problem.

Much the same might be said of heart disease and cancer. Both have been increasing rapidly, in proportion to other diseases, but some of the apparent increase, especially in the case of cancer, has been due to increasing accuracy of diagnosis. Another important factor is that as medical science conquers infectious diseases, which used to be very prevalent, that leaves more people to die of chronic diseases. Be that as it may, there is a pretty regular graduation in proportion of deaths from heart disease and cancer from the more cultured to the less cultured states. I pointed out the correlation between cancer and civilization in a letter to the Montgomery Advertiser of March 29, 1938, and had something more to say about it in this Journal, 17:24-25. 1945.

As far as we can judge by the records, there is much less cancer among Negroes than among whites. And it is not much of a problem in such "backward" countries as we have vital statistics for.

The following table shows the United States averages and the unweighted averages for four groups of twelve states each, arranged in order of the "Who's Who" native ratios of 1920. Most of the ratios have been calculated for two or more census years, to give some idea of how stable they are. But few data are given for later than 1930, partly because most of the calculations were made about twenty years ago, when the 1930 figures were the latest available, partly because the desired "Who's Who" ratios have not been available in recent years, and partly because of unsettled conditions in the last few decades.

The states in each quartile are not named, partly to save space, and partly to avoid offending boosters who might resent seeing their states rated low, and try to discredit the whole study. But it might be remarked here that the six New England states headed the list as late as 1930, but some of them might not rank so high now, for the old Puritan element with high ideals is being gradually

outnumbered by descendants of uneducated people who poured in in the 19th century to supply unskilled and semi-skilled labor for the numerous factories. And their rank has deteriorated since 1920, as the table shows. And Alabama is near the middle, instead of near the bottom as some critics of the South would like to put it.

It will be noticed that there is a pretty regular graduation, upward or downward, from the high to the low group, in nearly every line, which tends to confirm the validity of the indices used. Any one sufficiently interested to bring the study down to date, say after the 1960 census, might perhaps find some variations calling for re-evaluating some of the criteria.

CORRELATION TABLE OF SELECTED INDICES OF CULTURE IN THE UNITED STATES, TOTAL AND QUARTILES OF 12 STATES EACH
(White population only in most cases)

	Whole U.S.	High	Next	Next	Low
Average date of admission to U.S.	1835	1799	1815	1840	1885
Per cent of population urban, 1910	46.3	59.2	40.6	30.5	26.3
Per cent of population urban, 1920	51.4	58.6	45.9	35.4	29.2
Per cent of population urban, 1930	56.2	59.8	50.7	40.9	32.6
Per cent of ante-bellum houses standing in 1940	20.3	35.1	14.2	8.5	7.5
Who's Who natives per million, 1910	441	975	335	171	26
Who's Who natives per million, 1920	470	1019	424	255	75
Who's Who natives per million, 1930	505	965	482	321	145
Who's Who natives per million, 1936	414	838	451	328	171
Who's Who residents per million, 1910	208	313	137	110	117
Who's Who residents per million, 1920	242	352	173	143	139
Who's Who residents per million, 1930	266	396	193	185	218
Starred scientists per million inhabitants					
Cattell's rating, 1906 Natives	27.6	43.1	22.5	15.1	14.9
Residents	13.8	19.4	9.4	2.8	6.1
Ratio to natives, 1900	13.2	29.9	10.5	2.4	1.9
Patents issued, per million white inhabitants					
1906-1908	393	419	344	245	263
1934-1936	348	422	311	151	104
Women per white family, 1910	1.23	1.28	1.21	1.16	1.00
1940	1.19	1.22	1.19	1.16	1.06
Per cent of 15-20-year-old white females married					
1910	10.50	9.05	13.87	13.64	14.32
1920	11.50	10.20	13.17	14.18	14.63
1930	11.50	10.21	13.76	14.78	14.65
Per cent of white females over 45 single, 1910	7.91	10.17	7.54	5.61	3.33
1920	9.00	11.24	8.49	6.45	4.01
1930	9.21	11.25	8.59	6.86	4.34
Insane persons per million white inhabitants,					
1850	766	1147	491	411	263
1910	2135	2524	2008	1532	1263
1940	4545	5327	4127	3400	3304
Per cent of white deaths from heart disease, 1929-30	19.2	20.5	18.0	15.8	13.6
Per cent of white deaths from cancer, 1929-30	9.15	9.58	8.46	8.07	7.05

WILDLIFE RESOURCES OF ALABAMA'S PIEDMONT

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Alabama's Piedmont Region has never been popularized as an exceptional hunting or fishing area. Yet the physiography of this section is adaptable to production of a variety of game species and for the construction of fish ponds. Six counties are characterized as predominantly "Piedmont" counties and data for these will be given as a basis for the Region. The six counties are Chambers, Clay, Cleburne. Coosa, Randolph, and Tallapoosa.

The lowland slopes, valleys, and river bottoms in row crop cultivation in the Region support quail and rabbits. Mourning dove concentrations often occur in corn and grain fields during the hunting season. The uncultivated parts of the Region, however, are probably more suitable for forest game species—deer, squirrels, and turkeys—than to other game species. Much of the terrain is hilly or mountainous, being, therefore, more suitable for timber production than for cultivation. Dr. A. M. Pearson, Auburn University, Auburn, states the Piedmont is the best watered soil region of the state because of the plentiful spring heads.

Numerous valleys provide excellent pond sites and the heavy clay soil is especially suitable for holding water and for the building of dams. However, hidden underground crevices exist in some Piedmont soils, often resulting in loss of water from artificial ponds.

Game Inventory

In 1939 Dr. F. S. Arant, Auburn University, completed a questionnaire survey on the relative abundance of certain wildlife species in Alabama. The results tabulated for the predominantly Piedmont counties are listed in Table I.

In 1949 the Alabama Department of Conservation published a booklet entitled, "A Game Inventory of Alabama," by Frederick S. Barkalow, Jr. This publication listed the "trends" in the status, the location areas, and the occurrence and relative abundance of certain wildlife species in the state. According to game warden questionnaires, bobwhite quail showed an increase in the 1939-40 season as compared with the 1938-39 season in Chambers, Coosa, Randolph, and Tallapoosa Counties. "No change" in the quail population was indicated for Clay and Cleburne Counties for the period. The game warden questionnaire survey, however, for the 1940-41 season indicated a decrease in quail population for all above counties except Cleburne, in which an increase was indicated.

TABLE I

Relative abundance of wildlife species in six Piedmont counties, 1938.

Game or fur species	County and abundance factor					
	Chambers	Clay	Cleburne	Coosa	Randolph	Tallapoosa
Beaver	C	D	S	D	S	D
Bobcat	N	A	C	A	S	S
Bobwhite Quail	C	A	A	A	C	C
Cottontail Rabbit	A	A	A	A	A	A
Gray Fox	C	A	A	A	A	C
Red Fox	S	C	A	C	C	C
Gray Squirrel	A	A	A	A	A	A
Fox Squirrel	C	C	A	A	C	C
Mink	C	C	C	C	S	S
Mourning Dove	A	A	A	A	C	C
Muskrat	C	C	A	C	A	C
Opossum	A	A	A	A	S	A
Otter	C	D	S	S	D	N
Raccoon	S	A	A	C	C	S
Weasel	N	S	C	S	S	S
Whitetail Deer	N	S	N	D	N	D
Wild Turkey	S	C	S	C	S	D

Legend: A—Abundant; C—Common; S—Scarce; D—Doubtful; N—None.

In 1940 the eastern wild turkey was reported (Barkalow) in most counties wholly or partially within the Piedmont Region. The extensive ranges of this game bird were noted: Coosa County, and the hills and ridges extending along the Talladega—Clay and Calhoun—Cleburne County boundaries. Two deer and wild turkey population estimate surveys were conducted: One by Barkalow, spring, 1940; and another by George C. Moore, fall, 1940.

TABLE II

Deer and turkey estimates for six Piedmont Region counties in 1940.

	(Barkalow) Estimate		(Moore) Estimate	
	Deer	Turkeys	Deer	Turkeys
Chambers	Absent	12	Absent	Absent
Clay	Few	100	Absent	175
Cleburne	85	250	100	150
Coosa	Absent	200	Absent	200
Randolph	Absent	Absent	Absent	Absent
Tallapoosa	Absent	16	Absent	20

The estimated population of deer and turkeys in the six predominantly Piedmont Region counties is noted in Table II.

The beaver must necessarily be considered a forest fur species, chiefly because of its food, which mainly is the bark of hardwoods. In his report Barkalow indicates no beaver colonies were located in the six predominantly Piedmont Region counties as of October, 1940. However, there are reports now of beaver activity in all counties of the Region. In November, 1958, the writer made a trip to Coosa County and demonstrated beaver trapping techniques to landowners complaining of beaver damage. The demonstration area included six beaver dams. Beaver cutting activities indicated the presence of a strong beaver colony.

Natural waters in the six predominantly Piedmont Region counties are confined to portions of the Coosa and Tallapoosa Rivers and to the creeks that flow into them and into the Chattahoochee River. There are no large natural impoundments. However, Lay, Mitchell, Jordan, and Martin Lakes are large bodies of water created by dams. The natural productivity of fish in these rivers and impoundments is apparently lower than that for the other soil regions. For example, the fish population, determined by H. S. Swingle, Auburn University, in a section of Lay Impoundment, 1950, ranged from 60.9 to 144.4 pounds per acre, the difference resulting from various depths and types of water censused. In another check on the Coosa River, by Swingle, 1950, the yield of fish per acre totaled 191.72 pounds. Swingle determined the Tallapoosa River population at 45.7 pounds fish per acre. I. B. Byrd, Alabama Department of Conservation, sampled Lake Martin, October 2, 1958, and found the fish yield to total 71.48 pounds per acre. In contrast, the per acre yield in one section of the Tombigbee River in west Alabama, 1950, totaled 408.3 pounds, and in another section of the river, 1,055.6 pounds. In a "cutoff" in the Tombigbee River the recovery of fish per acre amounted to 1,859.4 pounds. Apparently the lower natural production of fish in the Piedmont natural waters and river impoundments is partially the result of excessively muddy water from the red clays washing into the stream plus fluctuation of water levels in large impoundments. Lack of nutrients in the waters may also be a contributing factor for the low productivity.

Fish ponds were limited in number prior to 1938. As a result of pond research at Auburn, the Auburn Agricultural Extension Service and other agencies, there are now a great number of artificial farm ponds in the Region. At least one public lake has been constructed and others are planned. The number of acres of water in

private fish ponds in the six predominantly Piedmont Region counties as of November, 1958, are tabulated in Table III.

TABLE III

Number and total acreage of artificial fish ponds in six Piedmont counties as of November, 1958.

County	No. of Ponds	Total Acreage
Chambers	180	800
Clay	225	746
Cleburne	139	700
Coosa	152	355
Randolph	118	382.5
Tallapoosa	214	571
Total	1,028	3,554.5

(Compiled by the Auburn University Extension Service from county agent annual reports.)

With the assumption of a basic production of 50 pounds fish per acre, the yield of these ponds is an estimated 177,725 pounds of fish annually.

Research and Development

The Auburn University Experiment Station and the Alabama Cooperative Wildlife Research Unit, Auburn, have been conducting experimental projects in the Choccolocco Wildlife Management Area in Cleburne County and on the Piedmont Substation near Camp Hill in Tallapoosa County.

At the Piedmont Substation the Wildlife Research Unit has conducted a quail study for eight years. Thirteen patches of bicolor lespedeza and ten patches of partridge peas were planted on the Substation, according to Dr. Maurice Baker, Unit leader, and Dan Speake, assistant leader. Number of quail covies on the area has ranged from eight to 13 through the 1957-58 season.

Bill Adams, PhD graduate student at AU, is conducting a study on deer management in the Choccolocco Wildlife Management Area. The last year native deer were reported in this area was 1916. In 1938 and 1942, a total of 65 whitetail deer was stocked in the Management Area. Legal buck kill results from managed hunts in the area beginning in 1948 were as follows:

1948	1949	1950	1951	1952	1953	1954	1955*	1956*	1957*	1958*
70	15	19	42	47	70	101	91	131	107	205

Total number of legal deer harvested is 898 animals. The low

* Spike bucks were legal.

bag limits in 1949 and 1950 may be correlated with the unexplained deer die-off noted in 1949.

Adams estimates the total number of deer in the Management Area to be 3,500 animals. The 1959 season may produce a concentration of 80 deer per square mile in the area. Possibly an either-sex hunt may be necessary in the near future to harvest a greater number of surplus animals.

Lua R. Blankenship, Auburn University graduate student, utilized the Piedmont Substation for a portion of his thesis, *Life History and Management Studies of the Gray Squirrel in Alabama.* One significant fact was his determination of one gray squirrel per 2.6 acres of range on the Substation in the fall.

Within the six predominant Piedmont counties lie an estimated 1,023,000 acres of standing timber with mast producing species of hardwood five inches dbh or larger. Since it may be assumed this acreage will support gray squirrels, the number of these animals in the six counties should roughly be 400,000.

Cottontail rabbit studies were also conducted on the Substation by Edward Majors, 1955 Auburn University graduate student. On one trapline on the Piedmont Substation the maximum population of cottontails was 22.6 to 24 per 100 acres in a farm woodlot. Census of idle land in the Piedmont just north of Auburn, Alabama, indicated a population of 51.8 cottontail rabbits per hundred acres.

Based on these data the population of cottontail rabbits in the six predominantly Piedmont counties may be assumed to number more than a million animals.

The Alabama Department of Conservation has established wildlife management areas in Randolph, Coosa, and Clay Counties.

The Tallapoosa Management Area of roughly 40,000 acres was located in Randolph County in the vicinity of Wedowee, Lineville, and Malone. R. W. Thrasher, Department of Conservation, states that 71 whitetail deer and 23 eastern wild turkeys were stocked on the Area in 1948. Managed hunts for deer and turkey have been conducted. According to Francis X. Leuth, Department of Conservation, the estimated legal kill of buck deer on the Area was as follows: 18 in 1956; 62 in 1957; and 30 in 1958. The Area was released from control by the Conservation Department in 1958.

The Coosa Management Area was formed in 1952 with the original area of 25,000 acres, which has been expanded to 40,000 acres. Sixty whitetail deer, live-trapped in southwest Alabama, were introduced into the Area. No eastern wild turkeys were stocked because they were present. Only spring hunting seasons for turkeys

have been permitted since 1955. Legal kill results for these spring seasons on this Area are as follows in number of turkey gobblers: 1955, 20; 1956, 19; 1957, 18; 1958, 16.Two two-day dog deer drive hunts were conducted in 1958 with four legal bucks bagged. Kill tallies for other game in the Area have been recorded:

	1956	1957
Quail	153	1,066
Rabbits	32	40
Squirrels	476	546

In Clay County the Hollins Management Area of 25,000 acres was approved by the State Conservation Department in 1958. Deer will be stocked in this area.

Food patches for deer and turkey have been planted in all management areas to supplement natural food shortages. County agents have aided landowners in developing their land for game production by providing them with cultural recommendations for planting quail, dove, turkey, and deer foods.

Discussion

As a result of surveys, research, and management which have been conducted, it is apparent an increase of fish and wildlife resources in the Piedmont Region has been effected. Ponds have been built to provide recreation and food. From all indications, the number of ponds will continue to increase in future years. The low production of fish in rivers and large impoundments is possibly the most adverse element in natural fishery development. Controlling erosion through better farming practices and planting of timber in appropriate areas will probably do more than any other factor towards reducing the amount of muddy water and consequently an increase in natural fish production in these waters.

Introduction and harvest of deer and turkeys have proved the value of the Piedmont Region for production of these species for hunting. With proper management of open range, quail production could be improved.

Summary

Terrain and flora of the Piedmont Region are particularly suitable to development of whitetail deer, eastern wild turkey, gray squirrels, and for construction of farm fish ponds. The Region also supports bobwhite quail, cottontail rabbits, and apparently increasing numbers of beavers.

Low natural fish production of rivers and large impoundments in the Region is probably due mainly to the excessive muddiness of

waters by erosion of the heavy clay soils, the fluctuation of water levels in large impoundments, and lack of necessary nutrients in the waters.

Research and development projects carried out by Auburn University, the Alabama Wildlife Research Unit at Auburn, and the State Department of Conservation have aided improvement of wildlife resources in the Piedmont Region. Wild turkeys and white-tail deer are now stocked in areas where they were extirpated. Hunting of these species is now possible in some counties of the Region. County agents and other agricultural personnel are encouraging the construction and better management of ponds and promotional projects for game.

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PROGRESS IN SOIL, WATER AND WOODLAND IN ALABAMA'S PIEDMONT

O. C. MEDLOCK

Soil Conservation Service, Auburn, Alabama

Approximately three million acres of Alabama's land lies in the Piedmont. The data I use are taken from 1935 and 1955 census reports and from Soil Conservation Service reports on soil conservation accomplishments for counties in the Piedmont. The data are not exact, but are accurate enough to clearly reflect changes that have come about in the Piedmont and soil conservation accomplishments.

First, let us look at some changes that came about in the Piedmont between 1934 and 1954.

	1934 (Acres)	1954 (Acres)	Difference (Acres)
Land in farms	1,984,000	1,734,000	-250,000
Number of farms	23,700	14,300	-9,400
Cropland harvested	585,000	251,000	-334,000
Woodland in farms	943,000	981,000	+38,000
Size of farms	83	121	+38

Summarizing these data, land in farms decreased one-quarter

million acres. The number of farms decreased about 40 per cent. Cropland harvested decreased 57 per cent. Woodland in farms increased four per cent. The average farm was 45 per cent larger in 1954 than in 1934. Each farm had only about three more acres in woods in 1954 than in 1934.

Before discussing soil conservation accomplishments, I want to be sure that you understand what is meant by conservation. As I shall use it, the word "conservation" means "the economic use of a natural resource for the greatest good to the largest number of people over the longest time." Conserving soil, water, and woodlands means using those resources for economic benefit—not just preserving them.

We often explain soil conservation as using the soil for crops it is most capable of producing while treating it for protection and improvement. We in the Soil Conservation Service think of farm land as being capable of producing one or more of four classes of crops—namely, cultivated crops, hay and grazing crops, timber crops, and wildlife crops. We think of cultivated crops as crops which require that the land be prepared and the rows planted each year or as crops grown in rotations with such crops. Hay and grazing crops are crops grown for hay or for grazing that require that the land be prepared only for planting the crops. The crops are mostly perennial grasses and clovers or reseeding annuals. Timber crops are those grown in woodland for saw timber, pulpwood, poles, posts, piling, and fuel wood. Wildlife lands produce food and cover for game animals and birds and we include in wildlife lands those lands used for farm ponds.

In helping farmers plan for conserving their soils we aim at getting them to use each field or parcel of land for the crops it is capable of producing good to high yields without being damaged by erosion or leaching and still its productivity is maintained or increased.

Good management, as well as wise land use, is essential to conservation. Management includes the use of adequate amounts of fertilizer and lime and the judicious removal of crops so as to maintain protective vegetative cover on the soil as much of the time as possible.

Our records show that farmers in the Piedmont cooperating with soil conservation districts since 1939 have done the following amounts of soil conservation work:

Basic farm plans	4,847
Land under basic plans	726,781 acres
Percent of land under basic plans	34

Percent of land in farms	42
Terraced	92,000 acres
Established vegetated waterways on	9,900 acres
Drained	11,900 acres wet land
Built	1,070 ponds
Planted trees on	17,000 acres
Planted kudzu on	24,000 acres
Planted sericea on	42,000 acres

Of all of the practices, perhaps a larger part of the trees are still on the land than any other practice. No doubt a considerable acreage of sericea and kudzu have been destroyed by over-grazing and by poor management; however, these crops have helped materially to increase livestock production in the Piedmont.

In very recent years interest in woodland conservation has increased greatly. This is particularly true of planting pine seedlings and controlling undesirable hardwoods on upland pine sites. During the past two years we have seen rather extensive areas in woodlands in Clay and Cleburne Counties on which some excellent work of controlling undesirable hardwoods had been done with amazing results. Young pine seedlings responded with remarkable growth, indicating that there was a full stand of trees ready to take over the woodland area.

The character of the soils of the Piedmont and the topography of the land indicate that the area is better suited for livestock and timber production than for row crops. The soils are heavy and require much power for plowing them. They are also very erodible when plowed. Piedmont soils produce good crops of small grain, hay and grazing crops. Some of the bottom lands along Piedmont streams produce good yields of corn. An abundant supply of good water is available from springs and live streams throughout the Piedmont.

In some counties there has been a rapid expansion in poultry production. The growing of poultry will fit well into an agriculture devoted primarily to producing livestock and timber. The litter from poultry houses can be used effectively to increase the fertility of land used for grain crops and pastures. The trend is toward an agriculture based on livestock, poultry and timber production. With this type of agriculture an effective program of soil, water, woodland, and wildlife conservation is both practicable and economical.

TIMBER RESOURCES IN THE ALABAMA PIEDMONT

WILLIAM R. SIZEMORE

Auburn University, Auburn, Alabama

Today, as I rode from Tallassee to Auburn, my route was roughly parallel to the south boundary of the Piedmont. A tract of timberland which I own lies along the transition line adjoining Saugahatchee Creek. The S.C.S. soils surveyor for this District tells me that in some of this area there is a layer of Coastal Plain material on top of Piedmont soil.

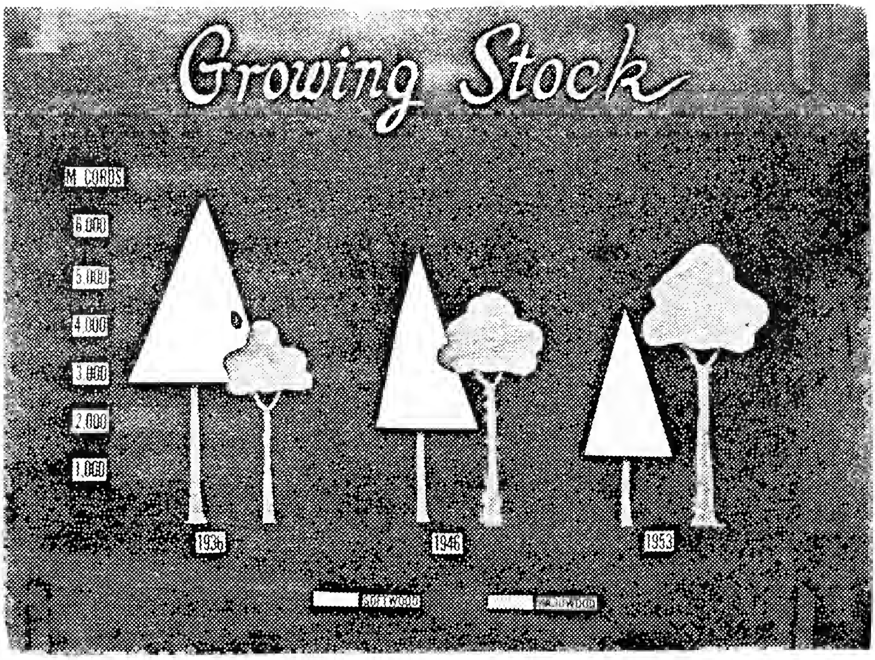
This tract of land and two other small places which are well within the Piedmont in Tallapossa County give me an especial interest in the resources of the Piedmont. I have owned one tract for 11 years, and the other tract I bought last year. I think that you can conclude from this that I have faith in the timber growing capacity of the Piedmont.

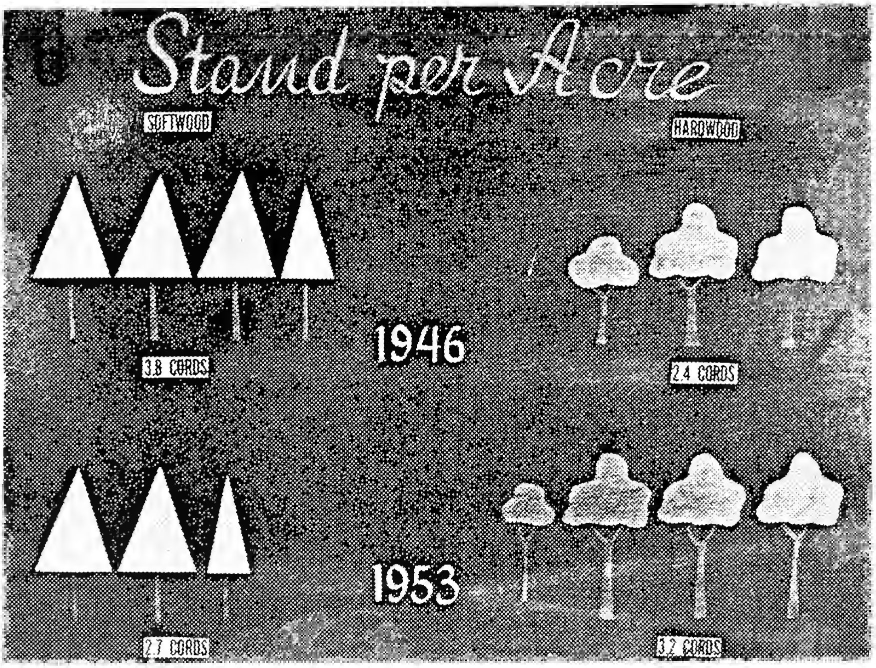
There are fragmentary descriptions of the forests of this area dating back to the Indian times. John Bartram, no doubt, touched a part of the area during his famous travels. Indians in this area cleared forests for their farms and livestock, hence, some of our so-called "virgin forest" may have been old field. Horseshoe Bend in Andrew Jackson's time was described as "One hundred acres furrowed with gullies and covered by small timber and brush."

The first quantitative study of timber resources was made in the course of the Forest Survey of 1936. To obtain the Piedmont Statistics, figures for the entire counties included in the area were consolidated. The per cent of the fractional counties lying within the area was applied to the total figures for those counties. Comparing these figures and others compiled since then, we discover some interesting facts about the Piedmont.

In 1936, the average per acre stand consisted of 3.8 cords of pine and 2.4 cords of hardwood.

1946 figures were obtained by updating the 1936 Survey, and showed an 8.6% decrease in the standing pine inventory. An entirely new survey was made in 1951-53. These new figures showed that from 1946 to 1953, there was a 17 per cent decrease in the pine growing stock, but a 10 per cent increase in the hardwood. This, of course, was the result of a change in product demand: the hardwood drain decreased 42 per cent, the pine sawtimber drain increased only 2 per cent, while the pine pulpwood drain increased 660 per cent. A significant proportion of this increase in


Growing Stock
M CORDS
6,000
5,000
4,000
3,000
2,000
1,000
1936
1946
1953
SOFTWOOD
HARDWOOD


Stand per Acre
SOFTWOOD
HARDWOOD
1946
3.8 CORDS
2.4 CORDS
1953
2.7 CORDS
3.2 CORDS

demand for pulpwood is attributable to the Coosa River Newsprint Company.

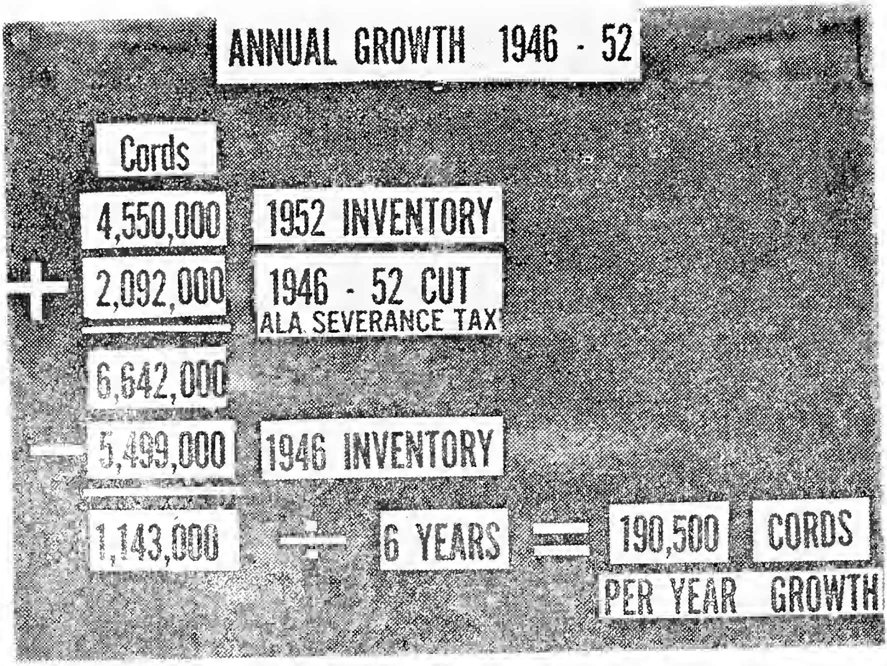
Measuring the total inventory in cords, we find that there were 2.7 cords of pine and 3.2 cords of hardwood per woodland acre in the Piedmont as of 1953. This is almost the exact opposite of the hardwood pine ratio in 1936.

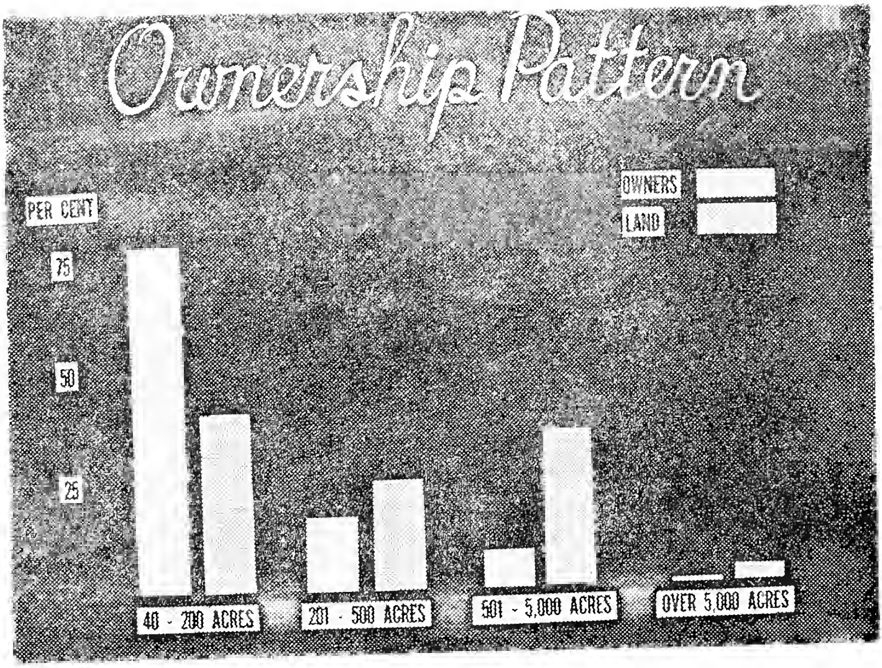
The timber resources in the Piedmont are controlled by the most effective law that we have on the books—the law of supply and demand. The price of sawtimber and pulpwood has responded to the increase in the demand for each. The same timber that 15 years ago brought $14.00 per thousand board feet, today brings nearer $30.00. The pulpwood that could be bought in the area for $1.50 per cord now brings at least $6.00. This increase in price has provided a stimulant to the interest that the average landowner has in his timberland. He wants to "get in on" the higher prices that timber now brings. Needless to say, in the timber business there is a time lag of ten to twenty years between the first step to improve timberlands and the realization of increased return.

Many landowners in the Piedmont have taken this step, judging by the increase in the number of seedlings planted in this area. In 1951, 1.3 million seedlings were planted. By 1958, this number had increased to more than 13 million, or 1,000 per cent. However, even if this is a fantastic percentage increase, the 13,000 acres planted last year is a small area compared to the 1,654,000 woodland acres in the Piedmont.

When the current annual drain in this area compare to the current annual growth, the situation appears alarming. By using the figures as shown in chart 3 to compute growth, we find that the average growth of pine in this area was 190,500 cords. The annual cut during this period was 349,000 cords. In the absence of current figures for Piedmont growing stock, the growth rate for the 1946-52 period has been projected to 1959. We do not have the statistics on the drain, however, and find that the cut last year was 468,926 cords of pine, or 246 per cent of the projected average annual growing rate. It is safe to assume that the actual annual growth rate has not exceeded that of the drain, if indeed, it has kept up with it. Thus, at the rate of decrease in pine inventory of 2.8 per cent per year which we had from 1946 to 1952, there would theoretically be no pine left in the whole area in 22 years. Since the hardwood is increasing, there would soon be 100 per cent hardwood stocking.

The law of supply and demand should reverse the trend. In 1955, the per capita consumption of sawtimber in the United States was 248 board feet and pulpwood was a quarter of a cord. The pop-


ANNUAL GROWTH 1946 - 52
Cords
4,550,000
1952 INVENTORY
2,092,000
1946 - 52 CUT
ALA. SEVERANCE TAX
6,642,000
5,499,000
1946 INVENTORY
1,143,000
6 YEARS
190,500
CORDS
PER YEAR GROWTH


Ownership Pattern
OWNERS
LAND
PER CENT
75
50
25
40 - 200 ACRES
201 - 500 ACRES
501 - 5,000 ACRES
OVER 5,000 ACRES

ulation of the United States is making a net gain of one person every eleven seconds. Every 17 days, the population increase would be equal to a city the size of Montgomery. The demand for timber products should increase tremendously if the per capita consumption of forest products continues at the same rate.

In 1957 an intensive study was made in several Piedmont counties to determine the ownership pattern in ownerships of 40 acres or more. It was found that 39 per cent of the land was in the 501-5,000 acres category and was owned by only 8 per cent of the landowners. Assuming this sample typical of the whole area, this would be 913 ownerships. Our present needs could easily be met if these owners practiced good forestry on their land. It would be a living example that would influence landowners all over the area, because this land is in every section. Based on our sample, 8,668 landowners have ownerships of from 40 to 200 acres. This group would be hard to reach individually, but would be greatly influenced by examples of their neighbors. Their land represents 34 per cent of the ownerships over 40 acres. To complete the pattern, 1,795 owners have 24 per cent of the land in ownerships of 201 to 500 acres, and about 7 owners have 3 per cent of the land in ownerships over 5,000 acres.

Tallapoosa County, in the heart of the Piedmont, was the first county in the state to have intensive efforts directed toward woodland rehabilitation. Until recent years it had more pine than any other county in the state. The site index in the Piedmont ranges from 60 feet less on ridges to 100 in coves and alluvial bottoms. Assuming an average site index of 75 feet, the capacity of Piedmont woodlands is a million and a half cords a year or nearly 8 times as much as the present growth. The least that can be said is that there is plenty of room for improvement.

Within two miles of our meeting place today, a stand of timber is being cut that illustrates the way a landowner can discover the potential of his land. This land belongs to a widowed school teacher. This charming little lady, in her sixties, I suppose, knew that she had 88 acres of land. Period. She heard someone mention that they had cut timber from their land by a selective marking, and that it had been profitable. She thought this over and quite sensible went to the Extension Service to seek advice on the possibility of doing something with the trees on her land. At their suggestion she sought professional help on this matter, and as a result, a conservative timber sale brought $5,500 which was more than she thought all of her timber was worth. Now that she rea-

lizes the value to be found in timber, she is anxious to continue to practice good forest management on her land.

The personal influence of people like this teacher will furnish the spark needed by our formal educational programs in forestry. Like the proverbial horse who just wasn't thirsty when led to water, so the landowner is not responsive to the various programs aimed at him, unless his interest is aroused. Or, as the old farmer said to the county agent when he was being advised just how he should be managing his crops, "Look, son, you're wasting your time—I ain't farmin' as well as I know how, as it is."

In general, the long range economic interest of the timberland owner is consistent with good forest management. This is not the case from a short term view. A good many timber stands have been completely liquidated in order to pay off a mortage or to meet some other pressing financial need. Even complete removal of a timber stand does not in the long run reduce the capacity of the soil to grow timber. We tend to classify the clearing of virgin forests for agricultural purposes as wasteful. Yet the land was being put to a higher use. One year's return from the land as crop land was many times the value of the timber removed. A surplus supply will keep the selling price of any product low and only after our surplus of timber was removed, did timber become of value.

Unfortunately there are other forces that are in conflict with continued production of a timber crop. For example, last week I visited a forest tract on which the Interstate highway is taking a right-of-way 300 feet wide running northeast to southeast and the Alabama Power Company is asking a right-of-way 200 feet wide running northwest to southeast. Each time the Interstate Highway crosses a forty, almost ten acres are lost to timber growing; each time this particular Alabama Power Company right-of-way crosses a forty, six acres are lost to timber growing. Not many people would stand in the way of the progress that is represented by the need for these rights of way.

Another threat to timber growing in the Piedmont is the practice of mining top soil. The removal of top soil takes land out of timber growing almost as effectively as an Interstate highway right-of-way. For example, an Appling soil with 12 inches of A horizon or topsoil would have a site index of 89 for loblolly pine. Remove this top soil and the site index drops to 57. In terms of yield, there is a change from 1.35 cords per acre per year to .5 cords per acre per year based on a 20-year rotation. This situation is not to be confused with clay, sand, or gravel pits. A one acre clay pit might furnish as much material as 15 to 20 acres where only the top soil

is removed. It is this type of situation where the owner's short run interest may run contrary to his long run interest and to the welfare of the community.

Action on the local level can best solve our woodland problems. What steps can be taken to insure a continued wood supply?

First, the federal, state, and county agencies that are set up to help landowners can continue to emphasize woodland conservation.

Second, forestry programs in our educational institutions should be expanded—especially the Department of Forestry at Alabama Polytechnic Institute. In secondary schools, emphasis should be put on the possibility of careers related to our forest industries.

Third, wood-using industries should continue their excellent advisory programs for the landowner.

Fourth, the organizations that are composed of the various groups interested in wood production should plan programs aimed at the individual landowner. Such programs as the Small Ownership Conference that was held in Montgomery last November, give the owners a chance to compare experiences and problems and at the same time obtain the advice of experts. The minutes of this conference show quite clearly the problems that the individual landowner is facing daily, all the way from how to get rid of kudzu in his woodlands, to how to get a loan.

There is no doubt that the future prosperity of the Piedmont will depend to a major degree on continued productivity of its forests.

RATIONAL APPROXIMATION OF REAL FUNCTIONS*

DANIEL E. DUPREE

Auburn University, Auburn, Alabama

It is the purpose of this paper to study the problem of obtaining a rational function $y=f(x)/g(x)$ for a given set of points (x_i, y_i), $i=0,1, \ldots, n$, which agrees with the desired function at each given point. Hildebrand, (Hildebrand, **Numerical Analysis**), considered this problem from the standpoint of continued fractions, using inverted differences in the formation of the fraction. Here we present a brief discussion of this method, then develop an algorithm for the determination of the rational approximation which eliminates a major disadvantage of the continued fraction approach. Finally, the two methods are compared to show the advantage of the algorithm over the continued fraction method.

* Abstract of full-length paper which was presented at the last annual meeting of the Alabama Academy of Science (1959).

THE SWEET GUM INDUSTRY IN ALABAMA AND FUTURE POTENTIALITIES*

GEORGE M. HOCKING

Auburn University, Auburn, Alabama

A study is being made of the production of the balsam, Sweet Gum, obtained from **Liquidambar styraciflua** Linne, as this is presently carried on in Clarke County and adjoining counties of Alabama. A similar product is obtained from the same species growing in Honduras but obtained by entirely dissimilar means. Three other **Liquidambar** species widely scattered in the eastern hemisphere are the source of similar balsams; of these, the method of preparation is well known for only one, the Levant storax, and this is different again from both of the American procedures. The methods used in the United States are rather unsatisfactory since they require the expenditure of considerable hand labor and procedures which are both crude and hazardous. As far as can be determined, the foreign methods have never been experimentally tried in this country. It would seem of value to American production of this material to experiment with these other methods of producing storax, and even to go beyond this and experiment with methods used in the preparation of other analogous products, such as Peru Balsam. Sweet Gum is in considerable and increasing demand in the medicinal, pharmaceutical, tobacco, perfumery, and technical fields. The exportation from Alabama is insufficient to supply the market, with the result that operations are now being carried on in eastern Texas. By facilitating production here and improving the quality of the product, considerable benefit should accrue to the State of Alabama.

* Abstract of full-length paper which was presented at the 1959 annual meeting of the Alabama Academy of Science.

OPPORTUNITY RECOGNITION IN MANAGERIAL ADJUSTMENT*

JOHN E. LEE, JR., and E. D. CHASTAIN

Auburn University, Auburn, Alabama

Management of farm businesses has been complicated by a dynamic agriculture. Changes stemming from this dynamism have created problems which logically require managerial adjustment through deliberate decision-making and action.

Current problem-solving activities by agriculturists proceed largely from the assumption that problems are given. This paper is based on the contention that this assumption is invalid—that problems are not always recognized. False assumptions with respect to the problem preclude a successful outcome of one's efforts to resolve his difficulty. A clearly defined problem is one of the prerequisites for sound reasoning.

The place of problem recognition is examined in relation to the characteristics of a dynamic environment. Evidences of weaknesses of existing frameworks for problem-solving justifies the addition of the problem recognition step in the development of a sound framework for managerial adjustment to change. Steps to facilitate orderly thinking in the definition of felt difficulties are outlined. Problem recognition, problem-solving, action, and acceptance of responsibility are offered as the four basic tasks in management.

* Abstract of full-length paper which was presented at the annual meeting of the 1959 Alabama Academy of Science.

NATURAL RESOURCES OF ALABAMA FOR DEFENSE*

HUGH D. PALLISTER

Geological Survey of Alabama, University, Alabama

For defense in cases of air-raids it is necessary to take care of violent explosions and this can best be done by underground chambers, preferably with 25 or more feet of hard rock cover, and with a soft material as a cushion above this.

In Alabama this protection can be gained in operating mines, natural caverns and artificial caverns. The air used in ventilation can be at least partially cleared of contamination by passing it through charcoal or fine coal. As the water would be rendered unfit for use by an atomic blast, special containers should be provided for storage. Bottles or oxygen under pressure should be stored in safe places for emergencies. Testing devices should be provided for testing the purity of the circulating air. Barriers across the openings of these underground safety chambers should consist of barite blocks, barite used as aggregate, lead, iron ore, zircon, ilmenite and other heavy minerals used as aggregate in the concrete of the protecting walls.

* This is an abstract of a full-length paper presented at the 1959 annual meeting of the Alabama Academy of Science.

A CORRECTION

JAMES F. DOSTER, UNIVERSITY, ALABAMA

In James F. Doster's article entitled "Social Science and the American Future," appearing in the January, 1960, issue of the *Journal* (Volume XXXI, pp. 173-177) the meaning of a sentence was reversed by a typographical error omitting the word *not*. The sentence in question (p. 176) should read: "The historians' performance does not live up to their standards!"

INSTRUCTIONS FOR CONTRIBUTORS

Editorial Policy:

Papers and abstracts of papers to be published in the Alabama Academy of Science Journal may be submitted by both Academy and non-Academy members at any time during the year. Priority, however, will be given to material submitted by members of the Alabama Academy of Science.

Full-length papers which are submitted for possible publication will be judged by a review board on the basis of original data presented and upon the interpretation or review made of the materials presented within a limit of 15 printed pages. An article exceeding this limit will be charged at the rate of $10.00 per additional page. Papers must be submitted solely to the Alabama Academy of Science Journal and must not be reprinted in another publication without the consent of the editor.

Manuscripts:

The manuscript should be typed double spaced allowing good margins. Captions and legends for figures should be typed on sheets separate from the text. Footnotes are not desirable and should be avoided whenever possible. Illustrations should not exceed 20 per cent of the text; the authors of more copiously illustrated articles may be asked to pay for the excess. The title of the paper should be as short as is consistent with clarity. Primary divisions may be indicated by central headings and subdivisions by italicized captions at the margin. Every paper should normally conclude with a summary of numbered paragraphs.

Abstracts of papers should not exceed 200 words and should not include illustrated materials except where absolutely necessary.

Figures:

All figures and tables should be numbered consecutively with legends included. Illustrations (including tables) should be planned to occupy the entire width of a page (4½ inches), and any portion of the height (7 inches). It is best to combine illustrations into the smallest possible number of groups. Original photographs should be submitted in the form of clear black and white prints on glossy paper. Care should be taken to see that they cannot be bent or folded in handling, and paper clips should not be used.

References:

References to literature should be cited by the author's name or by the literature cited reference number. The bibliography should be arranged alphabetically by author under the heading Literature Cited. Complete reference is necessary and the arrangement should normally be as follows: Harper, R. M. Some Menaces of the Study of Geology. Jour. of Ala. Academy of Science. 27:15-20. 1955.

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THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

VOLUME 31 JULY, 1960 NUMBER 5

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The Journal of the Alabama Academy of Science is published four times a year and is sent without charge to all members of the Academy. This volume, 31, has two extra issues, July, Number 5, and October, Number 6, to bring the publication year into conformity with the Academy's new fiscal year.

CONTENTS

PRESIDENTIAL ADDRESS

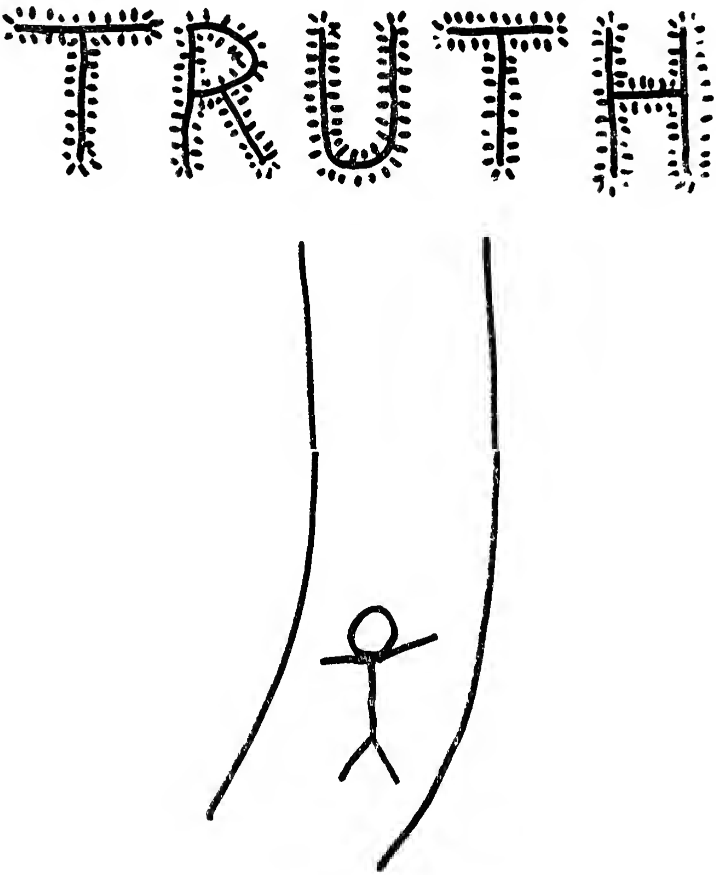
Montgomery, Alabama, April 1, 1960

THE ETERNAL QUEST FOR TRUTH

SAMUEL B. BARKER

University of Alabama Medical Center, Birmingham, Alabama

Tonight I want you to participate with me in a brief survey of the Eternal Quest for Truth: a permanent, never-altering Truth, so magnificent that one must perforce recognize it without doubt and accept it without misgivings. Man has undoubtedly always wanted to set up just such a clearly-defined notion of truth, simple to grasp, requiring just enough self-denial to insure that not all achieve it but not so much as to make one genuinely uncomfortable.



Some people feel so secure in their notion of such a Truth that they rail at everybody else in the world for not believing implicitly in the same Truth as they do and tend to blame all that is wrong on others' blind stupidity or blasphemous desire to alter this Unchanging Truth. For example, a recent editorial in one of our Birmingham community newspapers complained that, "Men try to change the Eternal Law . . . which is perfect." Any change makes it less perfect. If less perfect, the unnumberd "worlds" brought into existence by an All-Wise Providence and held in place by an unchanging law would be brought to disaster and ruin. The editorial held that the world today would be a happy place if man had always been content to be governed by the "Unchangeable Laws!"

Some see Truth in a blazing sunrise, some in a magnificent painting (although there is often a slight disagreement amongst Blake, van Gogh, and Kandinsky), and I must confess that I have felt more than once that J. S. Bach approached it in his stupendous choral setting of Ein Feste Burg. The trouble with this last is that some of my friends are distressed to have me say that Shostakovitch's Sixth Symphony does so, too. It is worth noting that very few classical music lovers will disagree about Beethoven, although in his own day he was widely accused of being a blasphemer for taking such musical liberties! Indeed, not only Beethoven, but the third of the three Great B's, Brahms, met a hostile reception, believe it or not, in the case of his first Piano Concerto.

Amongst Spanish peoples, the moment of truth is widely accepted as taking place as Warren Weaver so eloquently put it:

> . . . at each running of the bulls, after the haunting and foreboding pageantry of the entry; after the mad rush out through the gates of fear; after the grotesque ceremony of the picadores and the stylized precision of the banderilleros; after the exquisite skill and the frenetic bravado of the matador—then comes that quiet instant when beast and man face each other in motionless challenge . . . [11]

Others are simply horrified by this bloody slaughter.

It is well worth remembering that words themselves can mean quite different things to different people. I still recall with enjoyment a story I first picked up as a boy about the man who was astounded to see a sign in a barbershop,

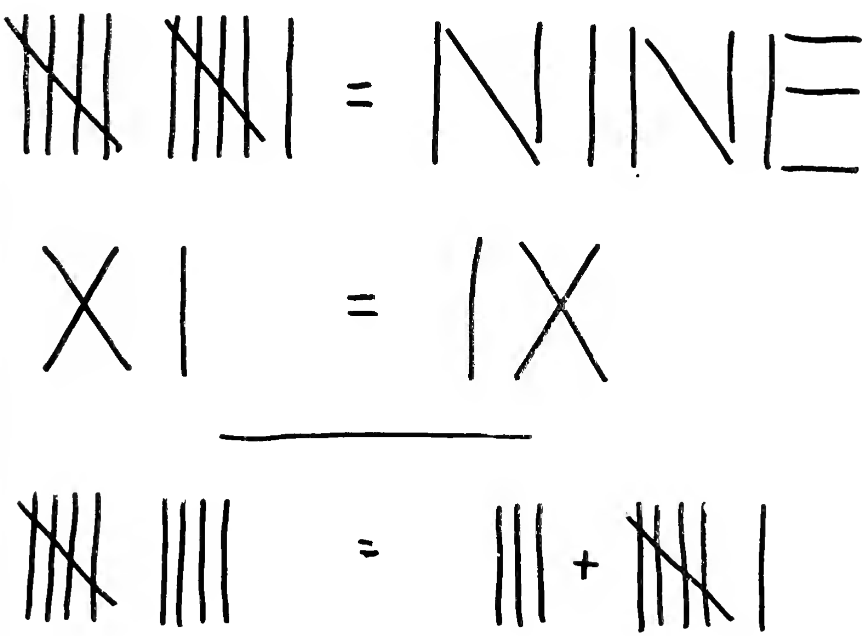
Tony the barber. What do you think:

I shave you and barber you for nothing.

Of course, he was overjoyed and immediately went into take full advantage of the offer. When the tonsorial operations were over, he started to leave, but Tony demanded to be paid. The man protested and quoted the notice on display. "Oh no," said Tony, "you read it all wrong. She say: 'What you think? I shave you and barber you for nothink?' "

Then, of course, you have all heard the common expression, "Nothing could be more valuable than that magnificent solid gold necklace!" This is asburd if one takes it to its logical extreme, that zero is actually greater than any material object. But this is not the way most people interpret the statement.

Some parlor games make deliberate use of such ambiguities. For instance, "Place eleven matches so as to make nine of them." Or the variation "Place eleven in matches so as to make nine of them." Then there is the even more outrageous one, "Place nine matches so as to make three and a half dozen of them." Since the hyphen in "half-dozen" has been left out of the last one, this deception is somewhat unfair.



Then there are words which have evolved two quite different meanings over their countless years of existence. A boat may be moving fast or it may be tied fast to the dock. A thief appropriates some one else's money for himself, but the legislature appropriates tax money for the schools. The drift of a discussion is important, but when a conversation drifts, the listener loses interest. We all know about "adequate" and "inadequate," but how about "flammable" and "inflammable"? "Unfair" is clearly the opposite of "fair," but how about "ravel" and "unravel"?

How can words be genuine or "truthful" when so many of them have lost their meaning through constant misuse? Take "Communist." This has come to mean anyone who doesn't completely agree with you. Personally, as a devotee of invective, I find the word disappointing as opprobrium. Of course, the English can add "bloody"—a really full-bodied expletive—but it, too, becomes monotonous. How much more soul-satisfying to say, "Because of So-and-So's short-sighted outlook, inadequate background, and complete lack of understanding of the situation, this feather-brained individual is unable to appreciate the true value of my opinion." This really puts matters correctly. "Communist," indeed!

Then there are some terms which have become so involved technically as to require a special translation in order to be understood.

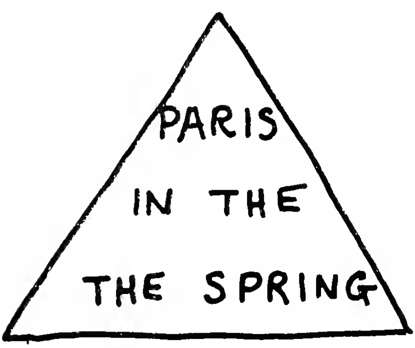
Technical Term	Interpretation
. . . a preliminary study of the problem is being made.	. . . I am trying to find out what this is all about.
. . . a literature survey of the problem is being made.	. . . somebody told me that he thinks there is a paper on a related problem in the *Analytical Edition* of either July 21, 1934, or June 12, 1943. Both of these issues seem to be missing.
. . . work has been started.	. . . Sargent promises delivery on the necessary reflux column in two months. All of the vacuum pumps are tied up at the moment.
. . . work is progressing.	. . . have succeeded in finding vacuum pump.

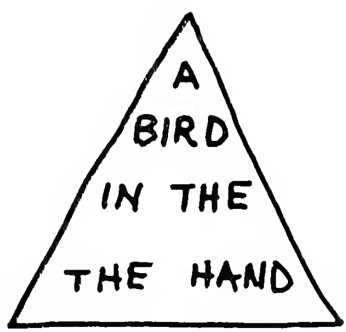
. . some delay has been incurred in finding special equipment.	. . . no clean 50 cc beakers.
. . the final phase of the work is being completed.	. . . the reflux column has arrived by way of California with seven of the eight bubble caps broken but otherwise in good condition.
. . preliminary experiments have shown.	. . . we did it once but couldn't repeat it.
. . a surprising finding.	. . . we barely had time to revise the abstract.

One can even go as far as Bennett Cerf in frivolous meanings of words:

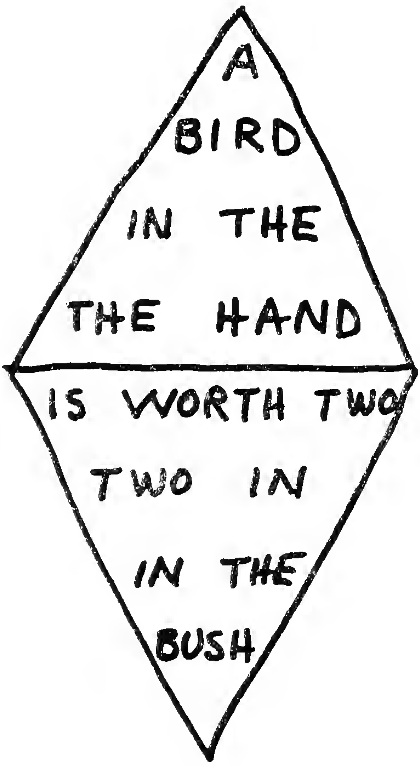
Fad: Something that goes in one era and out the other.
Forger: A man who goes out and makes a name for himself.
Gladiator: What the cannibal said after he dined on the lady explorer.
Loafer: A fellow who is trying to make both week ends meet.
Oboe: An ill wind that nobody blows good.
Psychologist: A man who pulls habits out of rats.

I should also like to point out that often our senses play tricks on us, misleading us into believing that we see things as they are not.





It is hard to believe that there is anything wrong with either of these familiar phrases until one is taken to such an extreme that it is obvious:



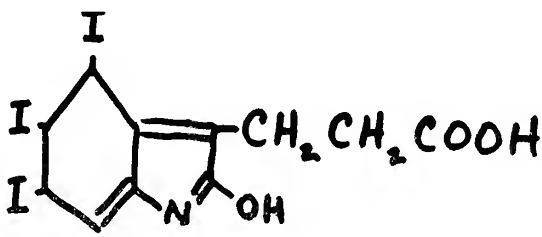
Before I am accused of being unduly facetious, I hasten to bring into the open the thesis I have been trying to present in subtle fashion: We should allow more flexibility in what we define as truth in making it available or even understandable to others. Remember that the very words in which we clothe our truth have their own strengths and weaknesses.

Truth, in fact, quite often depends on the historical context in which it is viewed. In 1813, iodine was first discovered in sponges.[2] When Coindet a few years afterwards undertook treatment of goiter with iodine, he created a fifty-year scandal. Later, in 1895, Baumann's reports of iodinated proteinaceous material present in the thyroid[1] plus Oswald's correlation of thyroid colloid with the iodine content of the gland in 1897[10] aroused further arguments, although not many years passed before it became well estab-

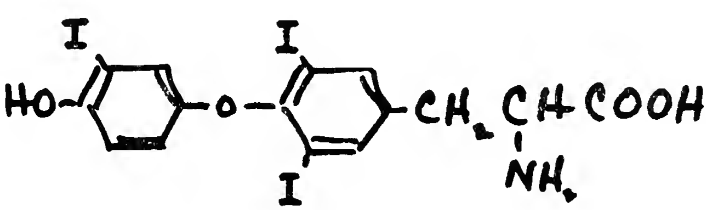
lished as being present to a higher level in the thyroid than in any other tissue. Marine suspected a correlation of geographical iodine lack with simple goiter and produced a similar situation experimentally.[7] Then, by the simple expedient of adding iodine to the table salt, Marine and Kimball were able to eliminate 74% of the goiter present in Cleveland school children.[8] Yet, for years there were some who completely denied any value in iodine administration.

An even more amusing example of the variabilities of truth in scientific research is to be found in a little publication of 1926, by two famous American physician-thyroid research men, C. H. Mayo and H. S. Plummer.[9] The latter wrote, "Kendall, in 1914, was the first to isolate from the thyroid a crystalline substance (iodin, 60 per cent) the definite chemical formula of which was determined in 1917. . . . This substance has been called "thyroxin," and has been shown to be trihydro-4,5,6, tri-iodo-2-oxybeta-indol-propionic acid. . . . It posseses the same physiologic action as the gland itself. It was synthesized in 1919."

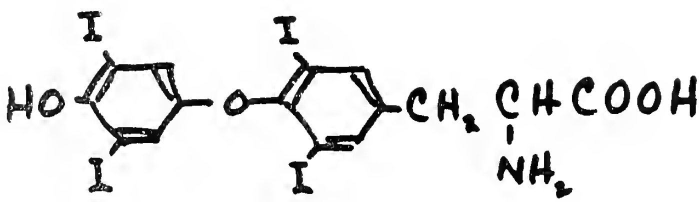
The formula indicated by the above terms would be:



Three of the statements made so definitely were quite true. Three of the others, equally positive, are now known to be wrong. Not only had thyroxine not been synthesized in 1919, but when its true synthesis was reported in 1927,[4] only one year later than Plummer's statement, the structure was quite a different one:

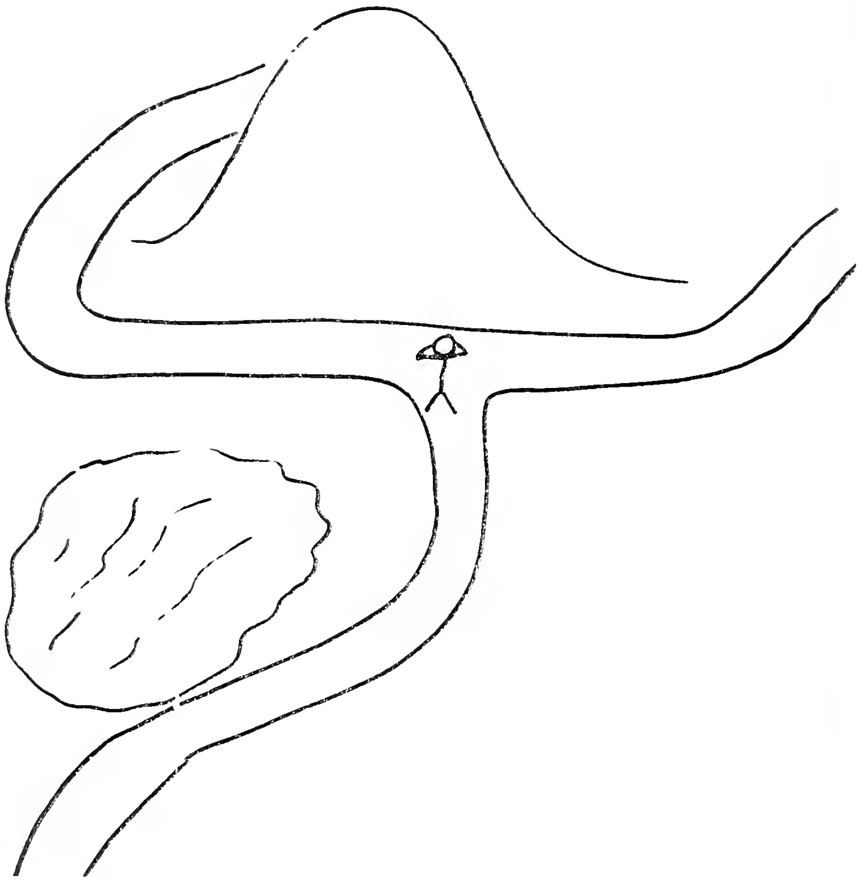


The real twist in the story came as recently as 1952, when a three-quarter iodinated thyroxine was first isolated:[3]



This was found in very small quantities, so that it can hardly be considered vindication of Plummer's rashly dogmatic earlier statement of the true structure.

An added fillip was recently contributed by a visitor to our laboratory who pointed out that two Australian biochemists had predicted in 1948[5] the existence of triiodothyronine, as this new substance is called. This remarkable discovery, then, could have



been made years earlier! Truth not only wears many disguises, but her presence may even be unsuspected in the midst of us!

In a somewhat broader philosophical tone, Professor Margenau of the Yale physics department recently looked at "Perspectives of Science" for Phi Beta Kappa.[6] He noted:

> In Western culture science is a pragmatic pursuit; it is the discovery of useful facts, whatever they may be. Its virtue lies in the honesty and accuracy with which these facts are gathered and in the completeness of the pattern that, as part of formulated knowledge, they finally compose. This factualness of science makes it blind to the differences between the trivial and the significant, the odious and the exquisite, the good and the bad; indeed the identification of science with the realms of discoverable fact has largely removed it from most basic human concerns and made it into a gigantic robot driving toward material progress.
>
> It is this obvious movement from discovery to the generation of a better material milieu that has captured our attention, engaged our fancy, and warped our appreciation of the true and abiding function of science in human culture. For it leaves out of consideration an obscurer movement, which accompanies the other with fateful inevitability, and which goes from discovery to understanding, wisdom, philosophy, straight into the affairs of the human spirit.

Since "one has to apprehend more than facts to discern the deeper effects of science," Margenau examined some of the undercurrents of scientific discoveries from the seventeenth century to our present time. He called attention to the present-day confusion,

> . . . man's thinking will be troubled by paradoxes and trapped in pseudoproblems if it embraces only part of the truth, and the texture of truth cannot be whole if the technological consequences of science are clear but its philosophic import is beclouded with contradictions.

We should search for the deeper humanizing meaning of science, distinct from its applied technological possibilities.

In order to discern the coming philosophy growing out of the underlying advances of science, Margenau pointed out facets of the growing crystal of science. "First is a courageous, healthful skepticism regarding the finality of all basic truths called axioms." An outstanding example was the movement away from Euclidean geometry. "Science had thus renounced absolute truth. But it

made this sacrifice gladly, for it gained thereby an affinity and a measure of deepened understanding."

"Science also relies increasingly on reason, often very abstract reason, and tends to be critical of common sense." It does recognize the need of this latter type of human wisdom as an occasional filling-in of an unclosed gap, but "when a clear claim of reason contradicts cherished beliefs it does ask their surrender, and it sometimes haughtily affirms that science itself gave rise to common sense."

There is also a trend toward "repudiation of mechanical models. . . . The microcosm of science was replete with minute wheels and gears, rods and strings, dumbbells and miniature solar systems." It has become necessary to realize that "entities too small to be perceived may have properties that likewise defy perception and require for their apprehension more subtle attributes than the objects of our daily experience." Although mechanical models may help in the early stages of understanding, the great strides made by that most abstract branch of science, quantum mechanics, stressed the need for a greater degree of freedom.

> An electron, according to this new branch of science, has under certain conditions no determinate position, energy, or speed at all; it may be in a state that can be pictured only as a cloud or wave or probability from which it emerges as a real physical entity only when a measurement is made.

Incidentally, the exclusion principle of quantum mechanics now is realized to apply to many systems other than the electron. Even in human behavior. if you insist upon knowing definitely what a person is doing at any given moment, you have no real chance of finding out where he would have gone if uninterrupted. Conversely, if you really want to determine his goal, the details of how he reaches it must often remain undetected.

"Finally, there is an element of daring," which moved Margenau to consider "adventure" as a better description of twentieth century science than "evolution" which characterized the nineteenth century.

In attempting to sketch "the nascent philosophy that is to provide an organic unity for the components of scientific method so briefly summarized," he felt that satisfying details could not be set down. However, he expressed the conviction that

> Its method will reflect the ongoing concerns, the dynamism of science itself. Like science, this philosophy will conceive its goal

to be an ideal one attainable only as a limiting answer to finite and often repeated human questions. . . . It will harbor no static certainties; while it will recognize meaningful eternal questions, it will brook no eternal answers, nor will it entertain timeless truths.

Are we ready for the New Perspectives of Science, the latest steps in this Eternal Quest for Truth?

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THIRTY-SEVENTH

ANNUAL MEETING

of the

Alabama Academy

of

Science

with the

GORGAS SCHOLARSHIP FOUNDATION

and the

ALABAMA JUNIOR ACADEMY OF SCIENCE

APRIL 1-2, 1960

HUNTINGDON COLLEGE

Montgomery, Alabama

General Program

Thursday, March 31

6:30 P.M.—Dutch dinner for members of the Executive Committee .... Whitley Hotel Lounge
8:00 P.M.—Executive Committee open meeting
Civic Room, Whitley Hotel

Friday, April 1

8:30 A.M.—Registration .... Flowers Hall, Huntingdon
9:30 A.M.—Section Meetings
I. Biological Sciences .... Room 101, Flowers Hall
II. Chemistry .... Room 201, Flowers
III. Geology and Anthropology .... Room 102, Flowers
VIII. Social Sciences .... Room 207, Flowers
IX. Medical Sciences .... Room 201, Flowers
12:00 Noon—Lunch
2:00 P.M.—Section Meetings
I. Biological Sciences .... Room 101, Flowers Hall
II. Chemistry .... Room 202, Flowers
III. Geology and Anthropology .... Room 102, Flowers
IV. Forestry, Geography and Conservation .... Room 2, Hut
V. Physics and Mathematics .... Room 3, Hut
VII. Science Education .... Forum room, Student Center
VIII. Social Sciences .... Room 207, Flowers
IX. Medical Sciences .... Room 201, Flowers
7:00 P.M.—Joint Annual Dinner, the Alabama Academy of Science and Alabama Junior Academy of Science. Blue-Gray Room, Whitley Hotel. Host: E. H. Sargent and Company.

Saturday, April 2

9:00 A.M.—Section Meetings
IX. Medical Sciences .... Room 201, Flowers
III. Geology and Anthropology .... Field Trip
10:30 A.M.—Annual Business Meeting .... Forum Room, Student Center
11:00 A.M.—Joint meeting, Alabama Academy of Science and Alabama Junior Academy of Science .... College Chapel
—Presentation of officers, Alabama Junior Academy of Science

—Presentation, State and Regional Counsellors and Regional Presidents, Alabama Junior Academy of Science
—Theme: PRESENT DAY VALUES IN SCIENCE EDUCATION
—What can a student expect from science in college and in graduate school? Panel discussion led by S. B. Barker and J. F. Volker

12:30 P.M.—Adjourn

Gorgas Scholarship Foundation

Thursday, March 31

Selection of winners of Alabama State Science Talent Search for General Gorgas Scholaships.

5:00 P.M.—Demonstration of exhibits to judges—Bellingrath Hall
6:00 P.M.—Banquet for finalists and judges
Montgomery Country Club
7:30 P.M.—Personal interviews of finalists by judges, Flowers Hall

Alabama Junior Academy of Science

Friday, April 1

9:00 A.M.—Registration .... Bellingrath Hall
10:00 A.M.—Preparation of exhibits .... Bellingrath Hall
10:30 A.M.—Conference of officers and official delegates
Room 2, Bellingrath Hall
10:30 A.M.—Conferences of sponsors and counselors, AJAS
Room 205, Bellingrath Hall
12:00 Noon—Luncheon for Executive Committee
Montgomery Country Club
1:30 P.M.—Business session .... College chapel
2:30 P.M.—Free swim .... College pool
2:30 P.M.—Judging of exhibits .... Bellingrath Hall
7:00 P.M.—Annual Dinner with the Alabama Academy of Science
Whitley Hotel

(Immediately following the dinner the Junior Academy of Science will enjoy a party in the State Room of the Whitley Hotel.)

Saturday, April 2

8:30 A.M.—General Assembly for presentation of scientific papers by regional finalists .... College chapel

9:00 A.M.-12:00 Noon—Exhibits on display .... Bellingrath Hall
9:00 A.M.—Business session .... College chapel
11:00 A.M.—Joint meeting of Alabama Academy of Science and Alabama Junior Academy of Science .... College chapel
12:30 P.M.—Dutch luncheon for members of old and new Executive Committees.

Section Meetings

Friday Morning, April 1, 9:30

SECTION I, BIOLOGICAL SCIENCES
Room 101, Flowers Hall
Robert A. Dietz, Chairman

1. **Biochemical Changes in Autoclaved Peanuts Caused By Four Additional Species of Storage Fungi.**
   U. L. Diener and N. D. Davis, Auburn University.
2. **Effect of Temprature and pH on Growth and Acid Production of Aspergillus Candidus and A. Tamarii on Peanut Extract.**
   N. D. Davis and U. L. Diener, Auburn University.
3. **Determination of Soil-Borne Fungus Populations.**
   James A. Lyle, Auburn University
4. **Compound Trees.**
   R. M. Harper, University of Alabama.
5. **Business Meeting.**

SECTION II, CHEMISTRY
Room 201, Flowers Hall
Kenneth M. Gordon, Chairman
Joint Meeting with Section IX — Medical Sciences.

SECTION III, GEOLOGY AND ANTHROPOLOGY
Room 102, Flowers Hall
Earl L. Hastings, Chairman

1. **Geology and Ground-Water Resources of Marengo County, Alabama.**
   John G. Newton, Ground-Water Branch, U.S. Geological Survey.
2. **The Economic Geologist in Industry.**
   Hugh D. Pallister, Geological Survey of Alabama.
3. **Some Notes on the Maquiritare Indians in Venezuela.**
   Paul H. Nesbitt, Research Studies Institute, Maxwell AFB.

4. **Use of Step Drawdown Tests to Predict Yields of Wells.**
Thomas H. Sanford, Jr., Ground-Water Branch, U.S. Geological Survey
5. **Some Evidence in Alabama of Vadose Zone Cave Formation.**
Thomas W. Daniel, Jr., Geological Survey of Alabama.
6. **Features of Caverns in Alabama.**
William W. Varnedoe, Jr., Redstone Arsenal.
7. **Recent Archaeological Excavations in Alabama.**
David L. DeJarnette, University of Alabama.

SECTION VIII, SOCIAL SCIENCES
Room 207, Flowers Hall
E. C. Paustian, Chairman

1. **The Intellectual Power of the Sociological Perspective.**
Chester W. Hartwig, Auburn University.
2. **Admiral Raphael Semmes and the Natural Sciences.**
Charles Grayson Summersell, University of Alabama.
3. **German Born Scientists of Huntsville, Alabama.**
Frances Roberts, University Center, Huntsville.
4. **Some Conceptual and Empirical Observations of Farm-Household Interrelationships.**
Charles L. Maddox and E. D. Chastain, Jr., Auburn University.
5. **The Influence of Age, Race, and Educational Background on the Comparative Intelligence of Negro and White Children in a Semi-Rural County in Alabama.**
Mabel Wilcoxson Thornton, Alabama College, Montevallo.
6. **Your Marriage Can Succeed.**
Nathaniel F. Forsyth, Athens College.

SECTION IX, MEDICAL SCIENCES
Room 201, Flowers Hall
Thomas E. Hunt, Chairman

1. **The Colorimetric Determination of Sulfhydryl Groups Using N-Ethyl Maleimide.**
Barbara P. McClung and Robert W. Longley, University of Alabama Medical Center.
2. **The Effect of Thyroxine on Carbon and Nitrogen Balances During Proline Metabolism By Kidney Slices.**
R. W. Hanson, R. H. Lindsay, and S. B. Barker, University of Alabama Medical Center.

3. **Effect of Ammonia and pH on Thyroxine Maintenance of Kidney Metabolism in vitro.**
R. H. Lindsay, R. W. Hanson, and S. B. Barker, University of Alabama Medical Center.
4. **Purification and Further Characterization of the TPN-Specific 17-Beta-Hydroxy (Testosterone) Dehydrogenase.**
Gerald L. Endahl and Charles D. Kochakian, University of Alabama Medical Center.
5. **Effect of Testosterone on the Metabolism and Incorporation of Glycine-2-C^{14} in Guinea Pig Tissues.**
C. D. Kochakian, G. Costa, and J. Hill, University of Alabama Medical Center
6. **The In Vitro Inhibition of Reduced Diphosphopyridine Nucleotide Oxidase of Guinea Pig Liver.**
B. R. Endahl and C. D. Kochakian, University of Alabama Medical Center.
7. **Bovine Submaxillary and Sublingual Mucins.**
Y. Hashimoto, S. Tsuiki, and W. Pigman, University of Alabama Medical Center.
8. **The Stability of Hyaluronic Acid Under Various Conditions.**
S. Rizvi, W. Pigman, and H. L. Holley, University of Alabama Medical Center.
9. **Business Meeting.**

Friday Afternoon, April 1, 2:00

SECTION I, BIOLOGICAL SCIENCES

Room 101, Flowers Hall
Robert A. Dietz, Chairman

1. **The Life Cycle of Netrium Digitus.**
Paul Biebel, Mobile.
2. **Effects of Industrial and Domestic Pollution of the Black Warrior River on the Net Plankton Population.**
Joe Allen Farmer, University of Alabama.
3. **A New Genus and Species of Monogenetic Trematode Parasite on the Gills of the Grunion, Leuresthes Tenuis (Ayers), from California.**
Emmett W. Price, Jacksonville State College.
4. **Abnormalities in Embryonic Development of the Coturnix Quail.**
Carol A. Smith Padgett and Phyllis Smith Dice, Huntingdon College.

SECTION II, CHEMISTRY

Room 202, Flowers Hall
Kenneth M. Gordon, Chairman

1. **A Study of the Detection of Small Quantities of Acetophenetidin in Preparations.**
   George W. Hargreaves, Auburn University, Auburn.
2. **Effect of 6-Diazo-5-Oxo-L-Norleucine Upon Purine Biosynthesis in a Human Epidermoid Carcinoma.**
   Paula B. Wedeles, William A. Short, George G. Kelley, and Arthur J. Tomisek, Southern Research Institute.
3. **Absorption Spectra of Some Quinoline Derivatives.**
   W. B. Bunger and J. D. Capps, Auburn University, Auburn.
4. **Plastic Packaging Films for Irradiated Foods—Effect of Model Foods on Functional Properties of Films.**
   R. E. Burks, Jr. and B. C. Moses, Southern Research Institute.
5. **A Preliminary Report on the Synthsis of D-Mannosamine from D-Glucose.**
   Wolfgang Roth, James Wood, and Ward Pigman, University of Alabama Medical School.
6. **Reaction Products of Maleic Anhydride With Phenylhydrazines.**
   Frank J. Stevens and E. M. Burgess, Auburn University, Auburn.
7. **The Acid 0-4 Rule, H(8-G)EO(4).**
   Robert B. Scott, Jr., University of Alabama.
8. **The Quantitative Determination of Hexose in the Epithelial Mucins.**
   S. Tsuiki, University of Alabama Medical School
9. **Coordination Compounds of Niobium.**
   James E. Land, Auburn University, Auburn.
10. **Carbon Dioxide Fixation in Liver Homogenates.**
    Paul Melius, Auburn University, Auburn.
11. **Business Meeting.**

SECTION III, GEOLOGY AND ANTHROPOLOGY

Room 102, Flowers Hall
Earl L. Hastings, Chairman

Theme: "Status of Geologic Studies in Alabama."

1. **Ground-Water Investigations in Alabama.**
   William J. Powell, Ground-Water Branch, U.S. Geological Survey.

2. **Correlations in the "Coal Measures" in the Southeast.**
   Reynold Q. Shotts, University of Alabama.
3. **Resistivity Measurements As An Aid to Highway Geology.**
   Robert D. Palmore, State Highway Department.
4. **Ground-Water in Relation to the Russellville Brown Iron Ore.**
   Jack E. Morris, U.S. Pipe and Foundry Company.
5. **Business Meeting.**
6. **Status of Surface-Water Studies in Alabama.**
   Lamar E. Carroon, Surface-Water Branch, U.S. Geological Survey.
7. **Alabama Geology—A Challenge.**
   Douglas E. Jones, University of Alabama.
8. **The Amateur Mineralogist in Alabama.**
   E. O. Dahlen, Alabama Mineral and Lapidary Society.
9. **History of the Oil and Gas Industry in Alabama.**
   H. Gene White and Robert C. MacElvain, State Oil and Gas Board.

SECTION IV, FORESTRY, GEOGRAPHY AND CONSERVATION

Room 2, Hut

David E. Hampe, Chairman

Theme: "A Look at the Forest Resource in Alabama's Black Belt."

1. **The Changing Black Belt — A Geographical View.**
   J. Allen Tower, Birmingham-Southern College.
2. **Historical Aspects of Forests and Vegetation of the Black Belt.**
   J. M. Stauffer, State Forester, Montgomery.
3. **Progress in Soil, Water and Woodland Conservation in the Black Belt.**
   W. C. Aiken, Soil Conservation Service, Selma.
4. **Wildlife Resources of the Black Belt With Emphasis On What Is Being Done On Westervelt Game Reserve.**
   Howard R. Redmond, Gulf States Paper Corporation, Tuscaloosa
5. **Important River Developments in Alabama.**
   Richard Peacock, Tombigbee Warrior Development Association.
6. **Weather and the Irish Potato Crop.**
   Arthur R. Long, State Climatologist.

7. **The Howard College Natural Area.**
Herbert McCullough, Howard College, Birmingham.
8. **Business Meeting.**

SECTION V, PHYSICS AND MATHEMATICS

Room 3, Hut

R. E. Wheeler, Chairman

1. **Some More Curves Derived from Watt's Linkage.**
Roland M. Harper, University of Alabama.
2. **Temperature Effects of Photomultiplier Tubes.**
Dorwin L. Kilbourn, Auburn University.
3. **Advantages of a First Year Graduate Course in Group Theory for Physicists.**
Theodore S. Worozbyt, Auburn University.
4. **A Method for Determining the Corrected Concentration of 1-132 in Body Organs as a Function of Time.**
Thomas I. Hicks and William H. Bancroft, Jr., Howard College.
5. **Some Matrix Methods for the Solution of Characteristic equations.**
Jimmy Phillips, Howard College.
6. **Zener Diode Characteristics and Applications.**
Earl Lewis Cook, Auburn University.
7. **Modern Trends in Mathematics.**
Panel Discussion: Ben Fitzpatrick, Auburn University, Chairman of the Panel.
8. **Business Meeting.**

SECTION VII, SCIENCE EDUCATION

Forum Room, Student Center

Lucille N. Lloyd, Chairman

1. **Progress of Science Fairs in Alabama.**
George C. Twellmeyer, S. J., Spring Hill College, Mobile.
2. **Discussion and Questions.**
3. **Organization and Procedure of Mobile Regional Academy of Junior Science for the Past Six Years.**
Lucille N. Lloyd, Chairman.
4. **Work Shop for Science and Mathematics Teachers as Part of Science Fair Program.**
Mary Ward, Semmes High School, Semmes, Alabama.
5. **Discussion of Topics 3 and 4.**

SECTION VIII, SOCIAL SCIENCES

Room 207, Flowers Hall

E. D. Chastain, Jr., Acting Chairman

1. **Alleged Destruction of Southern Railroads in the Civil War.**
   James F. Doster, University of Alabama.
2. **Some Economic Aspects of the 1951 Occupational Disease Amendment to Alabama Workmen's Compensation.**
   H. Ellsworth Steele, Auburn University.
3. **Some European Angles of the Juvenile Delinquency Problem.**
   David Lee Rosenau, Jr., Athens College.
4. **Relation Between Thurstone's "Primary Mental Ability" Tests (P.M.A.) and Certain Visual and Ocular Anomalies Among Fourth Grade School Children.**
   Eleanor C. Overton and Glen W. Herren, Practicing Optometrists, Birmingham.
5. **The Negro in Panama: A Problem in Cultural Integration.**
   Marjorie B. Smith, Florida State University.
6. **A Partial Evaluation of the Economic Effects of Alabama's Vocational Rehabilitation Work.**
   J. Hollie Allen, Florence State College/Auburn University.
7. **Business Meeting.**

SECTION IX, MEDICAL SCIENCES

Room 201, Flowers Hall

Thomas E. Hunt, Chairman

1. **The Proliferation of Ganglion Cells on the Chick Chorio-allantoic Membrane.**
   Robert D. Yates, University of Alabama Medical Center.
2. **An Investigation of the Structures Supporting the Teeth by Means of Force-Movement-Time Studies.**
   Gilbert J. Parfitt, University of Alabama Medical Center.
3. **Microradiography of Bone and Teeth.**
   M. B. Quigley, University of Alabama Medical Center.
4. **Experimentally Produced Hardness Changes in Dentin.**
   I. A. Mjoer, University of Alabama Medical Center.
5. **Insulin Reserve As Indicated by the Tolbutamide Tolerance Test.**
   Buris R. Boshell, Fred Vroom, and Jack Strong, University of Alabama Medical Center.
6. **Intradermal Skin Test in Systematic Lupus Erythematosus.**
   Claude Bennett and Howard L. Holley, University of Alabama Medical Center.

7. **Serum Viscosity Studies in Rheumatoid Arthritis.**
Fletcher S. Stuart and Howard L. Holley, University of Alabama Medical Center.
8. **A Contribution to the History of Malaria.**
Roland M. Harper, University of Alabama.
9. **James Somerville McLester: Scientist-Physician.**
Emmett B. Carmichael, University of Alabama Medical Center.

Saturday Morning, April 2, 9:00

SECTION III, GEOLOGY AND ANTHROPOLOGY
Earl L. Hastings, Chairman

Field Trip to Coastal Plain fossil localities in the Montgomery vicinity. Field leader: Miss Winnie McGlamery, Geological Survey of Alabama.

SECTION IX, MEDICAL SCIENCES
Room 201, Flowers Hall
Thomas E. Hunt, Chairman

1. **Renal Excretion of Endogenous Metabolities. 1. Reversal By Glycine of Inhibition of Urate Excretion.**
Howard C. Elliott and H. B. Murdaugh, Jr., University of Alabama Birmingham Center and University of Alabama Medical Center.
2. **Biochemical Studies of Toxicity. I. Microdetermination of Thymol in Aqueous Solution.**
A. A. Walker, University of Alabama Birmingham Center.
3. **Components of the Vagus Nerve of the Rhesus Monkey.**
H. H. Hoffman, H. N. Schnitzlein, A. C. Hinton, and M. B. Quigley, University of Alabama Medical Center.
4. **The Gross Anatomy of the Cervical Sympathetic Trunk in the Rhesus Monkey (Macaca Mulatta).**
Marion Garrett, University of Alabama Medical Center.
5. **Electron Microscope Studies of Cellular Membranes in Glandular Tissue.**
John M. Shackleford, University of Alabama Medical Center.
6. **Simple Method for the Measurement of Lame's Elasticity Parameters of the Wall Material of a Cylindrical Tube with an Homogeneous, Isotropic, Elastic Wall. (Read by title.)**
Curtis L. V. Adams, Sachiko Hashimoto, and W. Klip, University of Alabama Medical Center.

FALL EXECUTIVE COMMITTEE MEETING

University of Alabama Medical Center, Birmingham
October 24, 1959

The meeting was called to order at 9:15 a.m. by Samuel B. Barker, President.

The following were in attendance and were introduced by the Secretary. Paul Bailey, Sam Barker, William J. Barrett, Reuben B. Boozer, Emmett B. Carmichael, E. D. Chastain, W. B. DeVall, Robert A. Deitz, Charles E. Feazel, James R. Goetz, Kenneth M. Gordon, David E. Hampe, A. T. Hansen, Roger W. Hanson, Earl L. Hastings, William D. Ivey, James L. Kassner, Jerome Kuderna, Herbert A. McCullough, E. C. Paustian, Charles Turner, George O. Twellmeyer, R. E. Wheeler, Carlton D. Whitt, James C. Wilkes, Patrick H. Yancey.

Motion No. 1. Motion by Father Yancey, seconded by Mr. Goetz, that the minutes of the March, 1959, Meeting of the Executive Committee be approved as mimeographed and mailed by the previous secretary. Motion passed unanimously.

The President called for reports of officers and committee chairmen.

Report of the Secretary by Mr. DeVall.

Your present Secretary was coerced into serving by a very persistent nominating committee which, with the assistance of Dr. Ralph B. Draughon, President of Alabama Polytechnic Institute, made acceptance of the office possible.

Records and supplies were obtained in May from the previous Secretary, Dr. Kaylor. A special fund, established by A.P.I., to be used to employ a part-time stenographer was used sparingly during the summer. The Secretary's alphabetical member file and section member file have been brought up to date. It is now being checked against the September 22, 1959, membership list prepared by Treasurer Barrett.

A letter, with an enclosure describing the duties of Academy vice-presidents and vice-chairmen, was sent to each person serving in these respective capacities. This was done in August.

A memorandum to all officers was mailed in July, outlining services the secretary's office would try to perform to expedite Academy operations.

All members of the Executive Committee, whose names were available to the Secretary, were notified of the Fall Executive Committee Meeting. Reminders of the October 24 meeting were mailed October 14.

Your Secretary suggests that all future motions before the Executive Committee and the Academy be consecutively numbered and

that they be set forth in the minutes as indented block paragraphs to facilitate ready reference. [*Editor's note. The suggestion was modified to fit printed material.*]

A further suggestion is made to the effect that the President consider having the Articles of Incorporation and By-Laws redrafted annually by a committee, if one or more changes are made during the year. Inconsistencies in both should be reconciled. For example, Article VIII, Section I, states that the officers shall include 6 trustees, but Section 6 of the same article excludes all trustees except the Chairman of the Board of Trustees from the officers constituting the Executive Committee.

It would be helpful to the Chairman of the Nominating Committee, the President, and the Secretary if a roster of officers, their periods of tenure, dates terms expire, and names were prepared and then revised annually.

Report of the Committee on Admission to Membership by Mr. DeVall.

This Committee consists of the Councilor of the A.A.A.S., the President-Elect, and the Secretary, who serves as chairman.

As of March 12, 1959, Academy membership totaled 538. During the period March 12-October 24, 1959, the Committee has processed 27 applications for membership, classified as follows: Individual, 21; collegiate, 6; total, 27.

Motion No. 2. Motion by Dr. Barrett, seconded by Mr. Hansen, that the reports of the Secretary and the Admissions to Membership Committee be accepted. The motion passed unanimously.

Report of the Treasurer by Dr. Barrett.

Bank Balance—October 15, 1959		$2,838.57
General Fund:		
Balance as of 2/5/59	$ 2,164.32	
Deposits	2,171.50	
	4,335.82	
Less disbursements	$ 1,597.99	
		2,737.83
Research Fund:		
Balance as of 2/5/59	$ 320.74	
Deposits	150.00	
	470.74	
Less disbursements	370.00	
		100.74
		$2,838.57

Motion No. 3. Motion by Father Yancey, seconded by Dr. Sensenig, that the report of the Treasurer be accepted. Motion passed unanimously.

Report of the Editor and the Editorial Board by Dr. Bailey.

This report is a combined report for the Editor and Editorial Board of the Academy *Journal* and will represent nothing more than a statement on the status of the *Journal*.

The membership has received Issue No. 1 of Volume 31 of the *Journal*. The proofs of material for Issue No. 2 have been read by the authors and are ready to be returned to the printers on Monday of next week. Material for No. 3 will also be mailed to the printers on Monday of next week. This issue will carry the membership list of the Academy. Material for the final issue of Volume 31 is tentatively assembled.

All full-length papers for the current volume have been received by the Editorial Board. Members of the Editorial Board and the Editor have also reviewed the manuscript for the Academy History at the request of President Barker and Mr. Cantrell.

Motion No. 4. Motion by Dr. McCullough, seconded by Mr. Hastings, that the report of the Editor and Editorial Board be accepted and that the President, the Editorial Board, and the Archivist consider problems of publishing the "History of the Academy" and seek solutions to these problems. (Discussion of the motion by several committee members brought out the following suggestions: Consideration should be given to reducing the length of the manuscript, where it might be published, the form and style in which it should be published, how the cost of the publication might be financed, and whether or not colleges and universities might share in the cost. It was further suggested that Mr. Peter Brannon, Department of Archives, Montgomery, Alabama, and a member of the Academy, be contacted to see whether or not his Department might assist in the cost of publication. It was assumed that few individual copies would be sold outside the Academy membership.) Following the discussion, the motion passed unanimously.

Report of the Newsletter Editor. President Barker reported for Dr. Boschung in his absence that little material has been received for incorporation into a newsletter. An abstract of the Fall Executive Committee Meeting minutes was requested. Discussion took place on whether or not a newsletter should be issued since the *Journal* of the Academy is now published quarterly. No formal action was taken on the latter suggestion.

Report of the Research Committee by Dr. Sensenig. A formal report was not submitted. It was brought out that awards are limited to three undergraduates and three graduates. A further comment revealed that no applications have been received for

grants. It was brought out that the rules under which students may compete need clarification.

Motion No. 5. Motion by Mr. Goetz, seconded by Dr. Bailey, that the report of the Research Committee be accepted and that the requirements be rephrased to imply that the student must be the sole author of the paper.

Motion No. 6. Motion by Father Yancey, seconded by Father Twellmeyer, that Motion No. 5 be amended by the addition of the phrase "the Research Committee redraft the requirements." Amendment passed unanimously. Motion No. 5, as amended, passed unanimously.

A discussion led by the President indicated that grants are available from the A.A.A.S. to the individual Academy in the amount of $50.00 per year. This amount may be accumulated for three years. Requests for research grants should be directed to the Chairman of the Research Committee, Dr. Sensenig. Research grants sponsored by the Alabama Academy now appear in the budget.

Motion No. 7. Motion by Dr. Barrett, seconded by Mr. Goetz, that the Alabama Academy of Science research fund be disestablished, except for $300.000 in the budget. Motion passed unanimously.

Report of Committee on Place and Date of Meeting by Dr. Barker in the absence of Committee Chairman Carr. The 1960 Annual Meeting of the Academy will be held on the campus of Huntingdon College in Montgomery, Alabama, April 1-2.

Motion No. 8. Motion by Dr. Bailey, seconded by Dr. Dietz, that the invitation of Huntingdon College be accepted. Motion passed unanimously.

Report of Local Arrangements Committee by Dr. Turner. No formal report was submitted. The Academy and the Junior Academy will be housed in downtown Montgomery hotels and all meals will be served at the Whitley Hotel. All meetings, exhibits, and so forth will be on the Huntingdon College campus. The cost per member of the Senior and Junior Academies will be kept to a minimum. A tour will be planned for the Junior Academy only. The E. H. Sargent Company will consider in November whether or not it will again sponsor all or part of the banquet expense. Dr. Turner asked for clarification regarding funds and support of miscellaneous expenses for the Local Arrangements Committee.

Motion No. 9. Motion by Dr. Barrett, seconded by Dr. Wilkes, that the Local Arrangements Committee develop an advance regis-

tration form and that the registration fee for the Senior Academy be raised from $1.00 to $2.00. Motion passed unanimously.

It is a function of the Executive Committee at its fall meeting to set the date for the call for papers for the annual meeting. This matter was discussed at length by those familiar with past program planning.

Motion No. 10. Motion by Dr. Kassner, seconded by Mr. Hastings that January 15, 1960, be set aside as the closing date for titles of papers to be submitted to vice-presidents of the sections and that February 15, 1960, be set aside as the date when all titles must be in the hands of the Secretary. Motion carried unanimously.

Report of Long Range Planning Committee by Dr. Barker.

This report is from a committee-of-one, held over from last year because of the difficulty in persuading anyone to make up a new committee. It should be enlightening to look over what we set up as Academy objectives last year and to see what has been going on.

Considerable progress has been made toward establishing strong Regional Junior Academies to tie together Junior Academy and Science Fair activities. The Mobile Regional Junior Academy was formally installed within a few weeks of the state meeting. Organization of three other regional junior academies is under way. Some minor difficulties are being encountered, as would be expected with any change in organization. One can confidently expect these to be overcome by the hard work being devoted by many of our members working under the capable direction of Dr. Wilkes as Permanent Counselor of the AJAS and Father Twellmeyer as State Coordinator of Science Fairs. The prospects are excellent for the eventual improvement of science fair exhibits as well as for Junior Academy presentations at the annual statewide meeting.

Our endeavors toward improving contacts between the Alabama Academy and the State Department of Education have borne fruit in the practical area of specific recommendations for high school science teaching equipment drawn up by Dr. J. C. Blair and Dr. James Kassner, with extensive consultation on the part of several Academy members and teachers participating in the summer teaching institutes. There is still hope for a conference on professional education in relation to subject matter mastery. No specific arrangements have been made, but we hope that the Academy may be able to stimulate this important discussion as soon as the necessarily delicate negotiations can be completed.

We drew up a fairly ambitious lecture-demonstration project proposing the scheduling of visits to high school science classes plus assembly of kits containing special apparatus in several fields of science. This was submitted to the National Science Foundation for grant-support but was turned down. There is considerable continuing interest from the high school science teachers for this supplemental teaching help, and we should proceed in conjunction with other professional groups to attempt to fulfill the need even on a less ambitious scale. With specific reference to NSF support for Academy activities, a recent conference in

Washington reveals that we may have better success if we can draw up a project involving the financing of our expanded Junior Academy activities.

There still remain unanswered questions related to the best type of annual meeting of the Academy: Closer coordination between Junior and Senior Academy activities and types of formal programs as well as continuing meetings during the year on a less than state-wide basis. The first of these will be met, we hope, by more joint Junior-Senior activities at our 1960 sessions. But the latter will depend greatly upon what Academy members themselves want to do. There is some criticism that the Academy does not exert itself during the long interval between annual meetings. Most of our members who would be apt to participate in intervening Academy functions seem to be fully occupied and those who have leisure time do not seem anxious to devote it to extra Academy activities.

Motion No. 11. Motion by Mr. Goetz, seconded by Father Twellmeyer, that the report of the Long Range Planning Committee be accepted. Motion passed unanimously.

Report of the Counselor of the Junior Academy of Science by Dr. Wilkes.

The Executive Committee of the Alabama Junior Academy of Science held its annual fall meeting on October 17, 1959, with Dean Charles Turner, Local Counselor, on the Huntingdon Campus. All officers, sponsors (with the exception of Brother Cyr), and counselors were present. Dr. Sam B. Barker, President, Alabama Academy of Science, and Mrs. Lucille Lloyd, Regional Counselor of Mobile Region, Alabama Junior Academy of Science, were also in attendance. Plans for the annual meeting of the Alabama Junior Academy of Science were discussed. The following items are herewith submitted to the Executive Committee, Alabama Academy of Science, for action:

1. The Alabama Junior Academy of Science annual meeting should be held concurrently with the Senior Academy. The recommended place and date of meeting: Huntingdon College, April 1-2, 1960.
2. The officers, sponsors, and counselors of the Junior Academy recommend a combined banquet of both Senior and Junior Academy members to be held at the annual convention in 1960.
3. The following budget, to be underwritten by the Senior Academy, is submitted for action of the Executive Committee:

A. Cash Awards, Exhibits: First Place Winners in Four Categories:

Biology	$25.00
Chemistry	25.00
Physics	25.00
Industry	25.00

B. Cash Award, Best Scientific Paper 25.00

C.	Academy Award Winner, Individual	25.00
D.	Academy Award Winner, School	50.00
E.	Purchase of ten cups for exhibits and papers	150.00
F.	Purchase of four pins or keys for AJAS officers	20.00
G.	General Expense Account, Permanent Counselor	80.00
	TOTAL	$450.00

A combined meeting for members of Alabama Junior Academy of Science and one of the sections of the Senior Academy will be welcomed as a continued feature of the tentative program.

As a matter of information to members of the Senior Academy, two Regional Counselors have been appointed:

Mrs. Lucille Lloyd, Mobile Region of the Alabama Junior Academy of Science.

Dr. Harold Strickland, Northeast Region, Alabama Junior Academy of Science.

Motion No. 12. Motion by Dr. Carmichael, seconded by Father Twellmeyer, that the report of the Counselor of the Junior Academy of Science be accepted and that the budget for the Junior Academy be increased in the amount of $45, making the total budget $450. Motion passed unanimously.

Report of the Coordinator of Science Fairs by Father Twellmeyer.

General

State Trusteeship. In accordance with the resolution adopted at the March 12, 1959, meeting of the Committee on Regional Science Fairs, steps have been taken to establish a trust committee and trusteeship to solicit and to receive respectively funds from state-wide industries and other state-wide sources to help defray the expenses of the several regional fairs. Negotiations are in progress with the Birmingham Trust National Bank regarding the establishment of such a trust agreement.

Alabama State Delegation to the National Science Fair. A proposal to have the finalists to the National Science Fair from the various regions in Alabama go as a state delegation under the care of two chaperones, one lady and one man, if adopted, would result in a saving for the regions of from $1,000 to $2,000 annually. This is approximately the cost of operating one of the regional fairs.

Suggested date of the 1960 Regional Science Fairs. Dr. C. P. Nelson, Executive Secretary of the Alabama Educational Association, by letter of April 7, 1959, informed the State Coordinator's Office that the annual convention of the A.E.A. would be held March 17-19, 1960. By Bulletin of May 15, 1959, it was suggested to the Regional Coordinators that the Regional Fairs in Alabama be held the weekend of March 10-12, 1960, if this could be done without local conflict.

Annual Regional Fair Reports. A form has been drawn up which is to be used by the Administration of the regions in making the annual report to the Science Fair Committee of the Academy. Use of the form to be filled out will not only simplify and facilitate the making of the

annual report but also standardize the report from the various regions and avoid the omitting of pertinent information about the condition of the region.

Mobile Region

Twenty-seven schools participated in the 1959 Mobile Regional Science Fair entering 305 projects. This was with a limitation of 10 projects per school for schools with five teachers of mathematics and science or less and two projects allowed per teacher for larger schools with a maximum of twenty projects from any one school. Fifteen of the schools participating were senior high and twelve junior high. At least sixteen of these schools held local fairs with over two thousand projects entered in them.

Cost of operation was apparently excessively high during 1959 due to the purchase of several years' supply of such items as award ribbons and certain operational forms. This will, however, reduce the apparent cost of operation for the next two or three years. Several economies of operation have also been worked out for the present year.

A summary financial report as of July 31, 1959, follows:

Deficit, end of 1958 operation	$ 419.44	
Total Cost of 1959 operation	1946.57	
Cash contributions received 1959		$1725.00
Deficit for 1959 operation	$ 221.57	
Total deficit to 7/31/59	$ 641.01	

The above deficit is carried on open account by Spring Hill College through an arrangement whereby the College pays all operational bills and charges same to the account of the Mobile Regional Science Fair. The Trust Committee reimburses the College semi-annually according to its ability to pay.

North Alabama Region

Because of transfer by his company to Durham, N. C., Dr. Arthur B. Beindorff has found it necessary to resign as Coordinator of the North Alabama Region. Dr. Beindorff will be greatly missed by all who participate in the Science Fair movement in Alabama.

Before leaving Decatur on October 19, Dr. Beindorff took steps to activate the Science Fair Committee of the North Alabama Region. The appointees to the Committee by the Coordinating Institutions are Mr. Carlton Whitt, Athens College; Dr. H. H. Floyd, Florence State College; Mr. Edwin Bartee, Huntsville Extension Center; and Fr. Charles Reiner, O.S.B., St. Bernard College.

Mr. Whitt was requested to call a meeting of this Committee for October 17 to nominate a coordinator to replace Dr. Beindorff and to bring about a reorganization of the region.

Before leaving, Dr. Beindorff also drew up an "Outline" of the operation of the North Alabama Fair which the Committee and the administrators of the fair should find very useful.

North Central Alabama Region

Because of press of duties, Dr. W. J. Wingo has found it necessary to resign as Coordinator of the North Central Region. In the early sum-

mer, before his resignation, Dr. Wingo arranged for the organization of the Science Fair Committee of the North Central Region. He has cooperated with this Committee in its reorganization of the region. It is hoped that he will find it possible to continue to give his interest and support. The Committee is composed of Dr. George W. Campbell, Birmingham Extension Center; Dr. Kenneth Gordon, Birmingham-Southern College; Dr. Herbert A. McCullough, Howard College.

Dr. McCullough has been appointed Coordinator of the region and is very active in its reorganization.

Northeastern Alabama Region

Dr. Houston Cole, President of Jacksonville State College, was advised by letter of March 16, 1959, of the action of the Executive Committee in establishing the Northeastern Alabama Region at his request. Mr. Reuben Boozer has been appointed Coordinator of this region. Mr. Boozer reports that Dr. Harold S. Strickland has been appointed Executive Secretary of the region and Regional Counselor of the Junior Academy. He also reports that the administration has plans under way for a good fair in their first year of operation. We wish them every success with this new region.

Southeastern Alabama Region

On February 27, 1959, Mr. Darwin L. Kilburn, Secretary of the Board of Trustees of the Corporation, reported that the Southeastern Alabama Region had voted to incorporate. He filed a corrected copy of the Constitution of the Corporation with the Office of State Coordinator of Science Fairs.

Dr. William T. Wilks, who is in charge of local planning for the 1960 fair which is to be held at Troy State College, reports that the fair will be held on March 11-12, 1960.

Resolutions

1. It is hereby moved that the Executive Committee instruct the Secretary of the Academy to write a letter of thanks and appreciation to Dr. Arthur B. Beindorff for his work as State Coordinator and Coordinator of the North Alabama Region and also extend the best wishes of the Academy to him in his new location.

2. It is hereby moved that the Executive Committee instruct the Secretary of the Academy to write a letter of thanks and appreciation to Dr. William J. Wingo for his work as Coordinator of the North Central Region.

Motion No. 13. Motion by Dr. McCullough, seconded by Dr. Wilkes, that the report of the Coordinator of Science Fairs be amended by the addition of Resolution No. 3 to read "The Academy appropriate $50.00 for use by the State Coordinator of Science Fairs" and that the report be accepted as amended. The motion passed unanimously.

Report of Cooperator with Science Clubs of America by Dr. Kassner. Report was not submitted. The Chairman reported that every effort would be made to continue during the current year the program outlined in the past.

Motion No. 14. Motion by Dr. McCullough, seconded by Dr. Wilkes, that the report of the Cooperator with Science Clubs of America be accepted. Motion passed unanimously.

Report of the Science Talent Search for Gorgas Awards by Dr. Carmichael.

[*Published separately in this issue, beginning page 366.*]

Motion No. 15. Motion by Dr. Hanson, seconded by Dr. Wilkes, that the report of the Science Talent Search for Gorgas Awards be accepted. Motion passed unanimously.

Report of the Science Education Committee. The report, prepared by Chairman Wilkes, was read by Dr. Dietz in the absence of the Chairman.

> It has been impossible to arrange a committee meeting for this fall. The Chairman is sorry to report that no progress has been made in arranging a joint conference with the State Department of Education. He believes the idea of the proposed conference is sound. Possibly the best progress can be made after the state science consultants are selected. These consultants have been made possible by the National Defense Education Act. It is my understanding that they will work closely with the colleges of the state. These will have direct contact with the State Department of Education through Dr. Meadows. It is my intention to contact these people as soon as they are selected and to offer the services of the Academy of Science. Possibly this contact will enable us to proceed with plans as outlined at the Executive Committee meeting last fall.

Motion No. 16. Motion by Mr. Boozer, seconded by Dr. Kassner, that the report of the Science Education Committee be accepted. Motion passed unanimously.

Report of the *ad hoc* Committee on Improvement of Science Teaching Equipment by Dr. Kassner. Dr. Kassner reported that the Committee was working up a set of experiments and equipment in the field of chemistry. Dr. Meadows, former state superintendent of education, now heads up this activity.

Motion No. 17. Motion by Dr. Carmichael, seconded by Dr. Hanson, that the report of the *ad hoc* Committee on Science Teaching Equipment be accepted. Motion passed unanimously.

Report of the Membership Committee by Mr. Goetz.

The status of membership in the Senior Academy by sections as of October 24, 1959, is shown in the following tabulation.

	Section	Ind.	Col.	Hon.	Com.	Life	Total
I	Biological Sciences	88	40	2	0	1	131
II	Chemistry	90	6	2	2	0	100
III	Geology and Anthropology	22	11	0	0	1	34
IV	Forestry, Geography and Conservation	47	0	0	0	0	47
V	Physics and Mathematics	41	7	1	0	0	49
VI	Industry and Economics	33	0	1	0	1	35
VII	Science Education	19	2	0	41	0	62
VIII	Social Sciences	37	1	0	0	0	38
IX	Medical Sciences	65	2	1	0	1	69
	Total	442	69	7	43	4	565

Motion No. 18. Motion by Mr. Hansen, seconded by Mr. Hastings, that the report of the Membership Committee be accepted. Motion carried unanimously.

Report of the Councilor of the A.A.A.S. by Father Yancey.

Since there has been no meeting of the A.A.A.S. after my report at the Auburn meeting of the Academy, there is little to report now.

Dr. John Yarbrough, past president of the Academy Conference of the A.A.A.S., has asked me to take part in a panel discussion to be held at the Conference meeting on December 28, on "Is the trend toward permanent headquarters and executive officers for Academies a good one?" I have been asked to uphold the negative. If anyone has any good arguments for this I would be glad to have them.

The Secretary received and passed on to me a copy of a letter from Dr. Amy Le Vesconte, Chairman of the Committee on Collegiate Academies of the Academy Conference. The Committee suggests that each academy plan a session for presentation of undergraduate papers at its next annual meeting. The purpose is to experiment on whether it should set up a collegiate academy. The A.A.A.S. each year gives two collegiate memberships (including a one-year subscription to *Science* to each academy). These could be used as prizes for the best papers presented at the above mentioned session. It is also pointed out that the A.A.A.S. does not restrict the use of the research grants it gives to academies, so that they can be used for undergraduates as well as for high school students. The Academy Conference is planning a conference on collegiate academies in the not-too-distant future.

I plan to attend the Council meetings and the Academy Conference of the A.A.A.S. in Chicago during Christmas week. Each academy is entitled to two representatives in the Academy Conference (but not in the Council). Therefore I would be glad to have another representative of our Academy appointed to participate with me.

Motion No. 19. Motion by Dr. Carmichael, seconded by Mr. Whitt, that the report of the Councilor of A.A.A.S. be accepted. Motion passed unanimously.

Motion No. 20. Motion by Dr. Carmichael, seconded by Mr. Goetz, that the Executive Committee on behalf of the Alabama Academy of Science, express to Father Yancey its thanks for the fine work done over many years serving as liason between the Academy and the A.A.A.S. Motion passed unanimously.

President Barker called for special reports from Section Vice Presidents.

Report for the Geology and Anthropology Section by Earl Hastings.

> During the last four months a directory of Alabama geologists has been compiled. This directory will be used as a mailing list to contact all geologists in the state. A special letter will be mailed in the near future pointing out the lack of educational facilities for Alabama geologists.
>
> It is hoped that this letter will stimulate participation in the next Alabama Academy of Science Annual Meeting where a theme of "Status of geologic studies in Alabama" will be emphasized in the Geology and Anthropology Section. All geologists will be urged to join the Academy.
>
> A questionnaire also will be mailed asking opinions on separating the Geology and Anthropology Section and on the desirability of holding geology field trips during the annual meetings.
>
> The Section Chairman believes that much earlier notice of the meeting time and place and the call for papers is necessary; therefore, geologists will be asked 5 months in advance to volunteer to present papers at the Annual Meeting.

Motion No. 21. Motion by Father Yancey, seconded by Dr. Kassner, that the report from the Geology and Anthropology Section be accepted. Motion passed unanimously.

There being no further old business, the President called for new business.

Motion No. 22. Motion by Dr. McCullough, seconded by Father Yancey, that the Committee on Place and Date of Meeting, chairmaned by Dr. Carr, study the many problems related to arrangements for annual meetings, and that this study consider the desirability of establishing the place and date of meetings in advance, as well as locating annual meetings geographically over the state. Motion passed unanimously.

The President read a statement received from Mrs. Lucille N. Lloyd, Regional Councillor, Alabama Junior Academy of Science, Mobile, Alabama. The Committee felt that no action should be

taken since the request related to the Junior Academy of Science and the action requested had been taken locally in the Mobile area.

Motion No. 23. Motion by Dr. McCullough, seconded by Mr. Boozer, that the Academy budget funds for the operation of the office of Treasurer and Editor and that the budget committee be informed of this action as it prepares the Academy budget for 1960-61. Motion passed unanimously.

Father Twellmeyer requested that the Committee advise him how colored students could participate in Science Fairs. It was agreed that the mechanics permitting such participation already existed and that Dr. Kassner would provide the necessary information through Father Twellmeyer so that the persons concerned could be advised.

It was announced that the current membership roster would be published in the next issue of the *Journal.*

There being no further business, the President invited all in attendance to lunch at his home, after which he adjourned the meeting at 1:38 p.m.

W. B. DeVall, Secretary

SPRING EXECUTIVE COMMITTEE MEETING

Whitley Hotel, Montgomery, March 31, 1960

The meeting was called to order at 8:00 p.m. by Samuel B. Barker, President.

The following were in attendance and were introduced by the Secretary. Paul J. Arnold, Paul C. Bailey, S. B. Barker, William J. Barrett, Herbert Boschung, Clyde H. Cantrell, E. D. Chastain, Jr., David L. DeJarnette, W. B. DeVall, Robert A. Dietz, Suzanne Ellard, Louis J. Eisele, S. J., James R. Goetz, Mrs. James R. Goetz, Kenneth M. Gordon, William C. Guest, Asael T. Hansen, Roger W. Hanson, Roland M. Harper, Earl L. Hastings, Thomas E. Hunt, William D. Ivey, Walter B. Jones, Jerome Kuderna, Mrs. Lucille N. Lloyd, E. W. Price, E. Carl Sensenig, H. S. Strickland, James F. Sulzby, Jr., Allen Tower, George O. Twellmeyer, S.J., Ruric E. Wheeler, Carlton Whitt, James C. Wilkes, Jr., William T. Wilks, P. H. Yancey, S.J.

The President ruled that the minutes of the Fall, 1959, Meeting of the Executive Committee be accepted as mimeographed and mailed by the Secretary.

President Barker called for reports of officers.

Report of the Secretary and the Admission to Membership Committee by DeVall.

Members who joined during the last year and who requested a Certificate of Membership may pick them up at the registration desk.

A more complete report will be made at the business meeting on Saturday.

The Admission to Membership Committee is made up of Father Yancey, Mr. Goetz and DeVall. The Committee would like to recognize Dr. Thomas E. Hunt and Mr. E. L. Hastings for their efforts in adding new members.

It is the recommendation of this Committee that Dr. E. B. Carmichael be elected an honorary member of the Academy.

Motion No. 24. Motion by Dr. Hanson, seconded by Father Eisele, that the reports of the Secretary and the Admissions to Membership Committee be accepted and that the Secretary notify Dr. E. B. Carmichael of the action of the Committee. The motion passed unanimously.

Report of the Treasurer by Barrett.

Balance March 14, 1959			$3292.96
Receipts			
Dues		$1839.00	
Annual Meeting		284.50	
Gifts		463.00	
Sales of Journal		21.00	
	Total	2607.50	2607.50
		Total	$5900.46
Expenditures			
Publication of Journal		$ 757.97	
Assistance to Junior Academy		200.00	
Academy Conference Assessment		20.30	
Student Research Awards		50.00	
Annual Meeting		806.20	
Research Grants		250.00	
Operating Expense		306.61	
	Total	2391.08	2391.08
Balance April 2, 1960			
Checking Account		2009.38	
Savings Account		1500.00	
		3509.38	3509.38
			$5900.46

The proposed budget for the Fiscal Year 1960-61 is as follows:

Anticipated Income		
Membership Dues		$1800.00
Registration Fees, Annual Meeting		300.00
Gifts		150.00
Journal Sales		25.00
Total		$2275.00
Anticipated Expense		
Publication of Journal		800.00
Assistance to Junior Academy		
Academy Award Winner, Individual	25.00	
School	50.00	
Awards for Papers	25.00	
Awards for Exhibit Winners	100.00	
Cups	150.00	
Pins or Keys	20.00	370.00
Student Research Awards		100.00
Research Grants		300.00
Academy Conference Assessment		10.00
Annual Meeting		325.00
Operating Expense		
Office of President	100.00	
Offices of Secretary & Treasurer	150.00	
Office of Coordinator of Science Fairs	50.00	
Office of Editor of Journal	150.00	
Office of Permanent Counselor to Junior Academy	80.00	530.00
Total		$2435.00
Anticipated Excess of Expense over Income		160.00

Motion No. 25. Motion by Dr. Jones, seconded by Mr. Sulzby, that the report of the Treasurer and the 1960-61 budget be accepted and approved respectively. After discussion by Mr. Sensenig who opposed the cut in research funds, Dr. Barker stated that $250.00 is in the A.A.A.S. treasury for use and this makes $550.00 for research. The motion passed unanimously.

Motion No. 26. Motion by Dr. Barrett, seconded by Mr. Goetz, that Article 1, Sections 4 and 5 of the By-laws be amended to read as follows:

Section 4: The membership year and the fiscal year shall correspond to the calendar year. New members joining prior to July 1 shall be members for that calendar year. New members joining on July 1 or thereafter shall choose whether their membership shall cover the current year or the year following.

Section 5: All members in good standing except Junior members shall receive a subscription to the *Journal*.

The motion passed unanimously. The membership application shall be revised in line with Motion No. 26.

Dr. Barker led a discussion on increasing the yearly dues from $3.00 to $5.00. Recommendations will be made at the 1960 Fall Executive Committee Meeting. Dues will be billed as of January 1. Honorary members are to be considered dues paid and entitled to the *Journal*.

Under the new fiscal year system, Volume 31 of the *Journal* will include six numbers and Volume 32 (1961) will consist of four issues as is customary.

Report of the Research Committee by E. Carl Sensenig. No formal report was submitted. Mr. Sensenig stated that he had a small amount of funds to work with and only one application for a $150.00 grant.

Motion No. 27. Motion by Father Yancey, seconded by James C. Wilkes, that the report of the Research Committee be accepted. After discussion by Dr. Barker, who suggested that the Academy members encourage students' interest in science as well as in receiving research grants and that anybody who is a member may request a research grant, the motion passed unanimously.

Report of the Counselor of the Junior Academy by James C. Wilkes, Jr.

On October 17, 1959, the Executive Committee of the Alabama Junior Academy of Science met and made plans for the annual convention to be held (April 1-2) concurrently with the Senior Academy on the Huntingdon campus.

During the year, routine procedures were followed and approximately 65 chapters have made plans for the convention which will include meetings, displays of exhibits, regional papers for presentation, banquet and party. Charters will be granted to fourteen new chapters at this meeting.

Regional organizations have been established and have progressed as summarized below:

Mobile Region: Mrs. Lucille Lloyd, Barton Academy, Fairview, Alabama, Counselor.

Senior High Members: 19 schools
Junior High Members: 8 schools
Two papers to be presented at annual meeting.

Southeastern Region: Prof. G. O. Spencer, Troy State, Counselor.

Senior High Members: 10 schools
Junior High Members: 3 schools
All papers submitted from A. G. Parrish, two to be presented at annual meeting.

Northeastern Region: Dr. Harold Strickland, Jacksonville State, Counselor.

Senior High Members: 24 schools
Junior High Members: 9 schools
All papers submitted from Anniston High, two to be submitted at annual meeting.

North Central Region: Miss Clustie McTyeire, Hueytown High, Counselor.

Senior High Members: 12 schools
Junior High Members: No schools reported.
Two papers to be submitted at annual meeting, one from Woodlawn High and one from Montevallo High.

North Alabama Region: No counselor elected.

Senior High Members: 6 schools
Junior High Members: No schools reported.
Two papers to be submitted at annual meeting, both from Huntsville High.

Selected Regional papers in competition at the 26th annual meeting of the Alabama Junior Academy of Science will be as follows:

Mobile Regional Winners:

1. Cecile Winderbiggler, Foley High School, "Study of Cancer."
2. Elizabeth Murphy, Murphy High School, "Rocket Propellants."

North Alabama Regional Winners:

1. John Thornton, Huntsville High School, "Photomicrography of Rotifer Reactions."
2. Victor S. Grimes, Huntsville High School, "A Space Laboratory."

Northcentral Alabama Regional Winners:

1. Eleanor Long, Woodlawn High School, "Experiments in Twentieth Century Problems."
2. Gisela Molgedei, Montevallo High School, "The Effects of Light on Radish Growth."

Northeastern Alabama Regional Winners:

1. Gibbens, Anniston High School, "Translocation of Radioactive Iodine."
2. Diana Hogginbotham, Anniston High School, (title not available).

Southeastern Regional Winners:

1. Peggy Gibson, A. G. Parrish High School, "Termite Differentiation."
2. Billy Bishop, A. G. Parrish High School, "Is Memory Dynamic?"

Motion No. 28. Motion by Dr. Tower, seconded by Dr. Bos-
accepted. Motion passed unanimously.
chung, that the report of the Counselor of the Junior Academy be

Dr. James C. Wilkes offered his resignation as Permanent Counselor due to personal reasons.

Motion No. 29. Motion by Father Twellmeyer, seconded by Dr. Gordon, that Dr. Wilkes be commended on his past work with the Junior Academy. The motion passed unanimously.

Report of the Coordinator of Science Fairs by Father Twellmeyer.

Coordinators for the Alabama Regional Science Fairs are:

Mobile Region: Rev. George O. Twellmeyer, Coordinator; Mrs. Roy E. Lloyd, Regional Counselor.

North Alabama Region: Mr. Carlton D. Whitt, Coordinator.

North Central Region: Dr. Herbert A. McCullough, Coordinator. Miss Clustie McTyeire, Regional Counselor

Northeastern Region: Mr. Reuben B. Boozer, Coordinator; Dr. Harold S. Strickland, Regional Counselor.

Southeastern Region: Dr. Howard E. Carr, Coordinator; Prof. G. O. Spencer, Regional Counselor

National Science Fair Affiliation:

In 1959, the then four regional fairs sent eight finalists to the National Science Fair in Hartford, Connecticut.

In 1960, the five regional science fairs have selected ten finalists to go to the N.S.F. in Indianapolis, Ind., May 11-14.

Delegation to the National Science Fair:

For the first time this year the delegates to the N.S.F. from the five regional fairs of Alabama will attend as a delegation from the state.

1960 Regional Fairs:

Reports from all of the five regions tell of very successful operations. A full report cannot be made until the Fall Executive Committee Meeting. Dr. McCullough, Mr. Boozer, and Mr. Whitt are to be congratulated on their reorganization of their regions and conducting successful fairs during their first year as Coordinators.

1961 Regional Fairs:

The date recommended by the Committee on Regional Science Fairs for the 1961 Fairs is the weekend of March 23-25.

Motion No. 30. Motion by Mr. Goetz, seconded by Dr. Bailey, that the report of the State Coordinator of Science Fairs be accepted. Motion passed unanimously.

After a discussion led by the President, April 7-8, 1961, was set as the tentative date for the Thirty-Eighth Annual Meeting of the Academy.

President Barker noted receipt of letter from John G. Arnold concerning A.A.A.S. proposal for National Junior Academy. The idea was brought up three years ago to get Science Fairs under supervision of the State Academies.

Motion No. 31. Motion by Dr. Tower, seconded by Father Twellmeyer, that the President be instructed to answer with a note stating the present situation in this state and recommending adoption of a comparable set-up in other states. Motion passed unanimously.

The meeting was recessed at 9:45 p.m. and reconvened at 10:05 p.m.

Report of the Cooperator to Science Clubs of America presented by Dr. Boschung in the absence of Dr. James L. Kassner.

> This year, over 500 of the white and Negro high schools of Alabama are affiliated with Science Clubs of America.
>
> The sponsor of each affiliated club received free of charge, a "Sponsor's Handbook," a pamphlet on "How to Organize Your Science Club," complete information on the National Science Fair and the National Science Talent Search for Westinghouse Scholarships, along with a great deal of free material on Science Clubs of America.
>
> Since many parents, educators, counselors and community organizations in the past have requested copies of the "Sponsor's Handbook" to promote interest in science, Science Clubs of America, 1719 N. Street, N. W., Washington 6, D. C., has made the "Sponsor's Handbook" available to these organizations and individuals at a cost of $1.00.
>
> The Speakers Bureau under the leadership of Mr. Herman Granberry, West Point Manufacturing Company, Shawmut, Alabama, was continued again this year.
>
> The Junior Academy, in cooperation with the Science Fair, has been organized into five regions under Regional Counselors who are to hold office indefinitely and to work in cooperation with the Permanent Counselor of the Alabama Junior Academy of Science. I would like to recommend that the Regional Counselors be organized under the leadership of the Cooperator to Science Clubs of America in Alabama.

Motion No. 32. Motion by Dr. Tower, seconded by Father Twellmeyer, that report of Dr. Kassner be received with no action on recommendation contained therein. Motion passed unanimously.

Report of Committee on Improvement of Science Teaching Equipment by Dr. Barker. Dr. Barker submitted to the Secretary the following statement prepared by A. R. Meadows, Assistant State Superintendent of Education, Montgomery.

> Alabama was one of the first of the half-dozen states to get a State Plan approved for Title III. The National Defense Education Act was not approved until September 2, 1958, and it hit local school officials and science teachers like a bolt out of a clear sky because of the lack of favorable publicity about the passage of the Act. The U. S. Commissioner of Education called the Chief State School Officers to Washington during the latter part of September to suggest operational plans for the National Defense Education Act, but regulations governing state plans were not registered as required by law until January, 1959. The Alabama State Board of Education approved the State Plan in general outline on Nov. 12, 1958, and the State Plan was modified to meet Federal regulations and approved by the U. S. Office of Education on February 2, 1959,
>
> The Title III part of the NDEA requires the State to set up priority of projects and a copy of standards applicable to projects. The priority

legal requirement created serious difficulties. Under State procedures, priority is given to schools with three teachers or more with the provision that a smaller school may be approved if a case is made locally to justify such approval. Priority is also given to local school systems that can match Federal funds dollar for dollar. Priority is also given to instructional materials that are current except for histories. Schools approved for science must have teachers with specific college training to teach science. The superintendent of education must show desire and intent to carry out the purposes of Title III through a budget application in which said superintendent certifies that Title III regulations will be met.

One of the difficult problems is that of gearing the Alabama fiscal year which ends September 30 to the Federal fiscal year which ends June 30 prior to the end of the State fiscal year.

Alabama threaded through the legal requirements of the Act and Federal regulations relating thereto and budgeted to spend the entire 1958-59 Federal appropriation of \$1.4 million matched by \$1.4 million in local funds. This was an outstanding achievement by local school officials. Because of proration in the State Minimum Program Fund, some of the local money had to be matched by local communities, but the local funds were raised and the entire amount budgeted for Title III purposes.

One of the significant keys to the operation of Title III in Alabama was the development of a master list of equipment and materials which has to be followed in purchases. The Alabama Academy of Science made recommendations for the master list and revisions thereto. Master lists of equipment and materials were gathered from Detroit, Chicago, and some of the other large cities in the United States in 1958 and from local school systems early in 1959. The original master list eliminated materials published prior to 1954 except for histories and dictionaries of science. The master list was of tremendous assistance to school boards in raising money and in clearing budgets in time to use the \$2.8 million for Title III purposes. Some of the equipment on the 1958-59 purchases are still being delivered and local school systems have through June 30, 1960, to secure claims on equipment delivered. The expenditures of these funds are safeguarded by requiring copies of invoices for all purchases and claim statements from local superintendents which are made on the basis that Title III purposes have been carried out in the expenditure of funds. All superintendents were furnished copies of the State Plan and copies of Federal regulations relating to their participation in the Act.

On October 16, 1958, county and city superintendents of education met at the call of the State Superintendent of Education and spent a day discussing Titles III and V, with most of the time spent on Title III. The superintendents were unanimous in requesting that a master list be provided for Title III purchases. A State Committee, appointed by the State Board of Education and nominated by the State Superintendent of Education, consisting of 11 county and city superintendents of education and one assistant county superintendent of education, with the democratic nominee for State Superintendent of Education, and the State Superin-

tendent of Education, proposed State plan operational procedures to the county and city superintendents of education and, after these procedures were discussed, the State Plan was formulated and presented to the State Board of Education in the November 12, 1958, meeting.

Of the $2.8 million budgeted last year for Title III purposes, approximately $2.5 million was for science. The breakdown in science was approximately as follows:

Minor Remodeling:		
Elementary Schools	$ 5,500	
Secondary Schools	136,000	
Combined Elementary and Secondary Schools	39,000	
Total		$180,500
Equipment:		
Elementary	393,000	
Secondary Schools	1,589,000	
Combined Elementary and Secondary Schools	333,000	
Total		$2,315,000

In budgets for the 1959-60 appropriation, there is a definite shift from science to mathematics and modern foreign languages. Some school boards have not found it possible to budget money to match Federal funds because of the anticipated proration in the Minimum Program Fund and the present 10% official proration. The 1959-60 appropriation can be budgeted through 1960-61 provided claims are made and paid on or before June 30, 1961, for legal expenditures.

The State employed 9 full-time science consultants and 1 part-time science consultant during the month of June, 1959. These consultants revised the State master list to propose quality and quantity standards and to add new equipment items to the list.

The State adopted the revised Title III master list and adopted the specifications of the Purchase Guide developed by the Chief State School Officers for the items in the Purchase Guide which were included in the State master list. Not all items in the Purchase Guide were included in the master list, such as general dictionaries and general encyclopedias. The master list is in a state of constant revision and periodically the revisions are filed with the U. S. Commissioner of Education, as required in the State Plan.

Full-time science education consultants could not be employed by the State Department of Education until State appropriations were made available to match Federal funds for administration and supervision, and such appropriations were not available until October 1, 1959. Steps were taken to employ science consultants after Oct. 1, 1959, with anticipation that some consultants could be released from their teaching duties near or at the end of the first semester of school. An outstanding elementary school principal, Miss Erline Curlee, with educational background in science, was employed effective the latter part of December. Three outstanding high school science teachers were employed as soon as they were released and are on the job. Another outstanding high school science

teacher will start work at the close of school in May.

Drive-in district conferences of science, mathematics, and modern foreign language teachers and high school counselors have been held at Jacksonville and Troy, and a similar drive-in workshop is being held at the University of Alabama on April 2, 1960. The enclosed agenda sets forth the general program of these workshops. State Education Department science consultants meet with buzz session groups to help in pushing thinking forward for the improvement of science education. Approximately 175 teachers attended the Jacksonville workshop, 125 attended the Troy workshop, and it is anticipated that a larger group will attend the workshop at the University of Alabama. On June 4-5, 1959, a similar type workshop was held with the white and Negro teachers in separate groups in Birmingham, Alabama, for the cities in Jefferson County. All of these workshops have been highly successful. The State pays the expense of one car from each high school to the workshop center and \$2.25 per diem for expenses of all those who attend the workshop except for counselors who travel on local expense matched by Federal funds.

Present plans call for state publications to include, first of all, a science publication on science laboratories to include a list of experiments by subjects recommended by the Alabama Academy of Science and the State science consultants.

The Alabama Academy of Science has been most helpful and most encouraging to the Title III program. Suggestions and recommendations of this group and of other responsible groups are solicited for the improvement of instruction in science education in this State.

A report from the Committee on Improvement of Science Teaching Equipment by J. C. Blair was received after the meeting. It is included in these minutes for the record but without action.

On June 20, 1959, the Committee met with science consultants from the State Department of Education. At this meeting, it was suggested that the Committee could serve best by making a list of selected experiments and the equipment necessary to perform these experiments in biology, chemistry, and physics. A minimum list was requested with enrichment items to be given in a separate list. The Committee has turned over to the state consultants these reports in biology and chemistry, and anticipates the physics report being in the hands of the chairman at an early date. The consultants have expressed appreciation to the Alabama Academy of Science for this work and state that this will be reproduced and distributed to the high school science teachers of Alabama.

Report of the Science Education Committee by William T. Wilkes, Chairman.

There has been no formal meeting of the Committee.

Several developments have to some extent modified previous plans of the Committee:

(1) The National Defense Education Act with its emphasis on science

and mathematics teaching. The State Department of Education now has several science and mathematics consultants who work with teachers in the state. The Academy may be better able to work with thse consultants in improving high school science and mathematics teaching.

(2) The NSF Academic Year and Summer Institutes are doing much to upgrade science and mathematics teaching in the State.

(3) The American Council on Education is now promoting conferences (Examples: Bowling Green, Lawrence, and Tallahassee) which bring together education and subject matter college teachers for discussions of mutual problems. These conferences have discussed problems similar to those proposed to the State Department of Education during the last two years. Perhaps the work conference on science teaching at the state level is no longer in need of promoting.

Motion No. 33. Motion by Father Yancey, seconded by Father Eisele, that the report of the Science Education Committee be accepted. Motion passed unanimously.

Report of the Editor of the Journal by Paul C. Bailey.

The Editor has no formal report except to bring the Executive Committee up-to-date on the status of the current volume of the *Journal.* Issues Nos. 1 and 2 were mailed to the membership as they were published several weeks ago. The Editor hopes that the membership received Issue No. 3 before coming to this annual meeting. The printers were attempting to meet this deadline although this means that they are three months behind schedule. Issue No. 4 should appear within a few days following this annual meeting since most of the work on this issue is nearing completion. I think that the group will be interested to know that several papers were submitted for possible publication for which there was no space in the *Journal.* Some papers were also received for possible publication during the year. These are indications, I think, that the Academy can look forward to a *Journal* which will carry papers more in keeping with its purposes.

Since this is the last report that I shall make to the Executive Committee as Editor of the *Journal* I should like to express my appreciation for the privilege of being able to serve the Academy in this respect. I should also like to acknowledge the very fine work of the Editorial Board in reviewing papers and advising the Editor. There are several other members who have helped the Editor by reviewing papers. I should like to thank them and especially recognize the contributions which Mr. Clyde Cantrell has made to the *Journal* in working with Auburn University with respect to finances, etc.

I feel that the Academy has made a significant step toward creating a *Journal* that can become outstanding as a State Academy Journal in years to come. This has been done, of course, by going to quarterly publication.

Motion No. 34. Motion by Dr. Tower, seconded by Dr. Hastings, that the report of the Editor of the *Journal* be accepted, and that the Academy express its appreciation to Dr. Bailey for the

excellent job he has done as Editor. Motion passed unanimously.

Dr. Barker announced that the successor to Dr. Bailey will be Dr. A. T. Hansen, University of Alabama.

President-elect James R. Goetz took the chair at the request of the President.

Motion No. 35. Motion by Dr. Barker, seconded by Father Yancey, that

(1) Drs. Paul Bailey and S. B. Barker be authorized to carry out the necessary editing of the manuscripts comprising the history for publication. Each revised chapter is to be returned to its respective author for his approval.

(2) Publication of the revised history be authorized as a supplement to the volume of the *Journal* of the Alabama Academy current at that time, in an edition of 1000. The Archivist of the Academy is requested to propose to the proper authorities of Auburn University that the same 50% support of printing costs so generously provided for the regular issues of the *Journal* be extended to this Historical Supplement.

Motion passed unanimously.

Report of the Archivist by Mr. Cantrell.

Volume 31, No. 3 of the *Journal* for January, 1960, was put in the mail this afternoon. Since the *Journal* became a quarterly, a great deal more work has been required in the office of the Archivist. A few times during the last two years there has been a slight delay in getting issues of the *Journal* in the mail. This afternoon, however, plans were worked out which should expedite the handling of the mailing.

In the past, both the Secretary and the Archivist have maintained separate mailing lists. Such a plan has apparently resulted in certain errors which should be avoided.

The new plan was worked out this afternoon in a conference between the President, the President-Elect, the Secretary, the Treasurer, and the Archivist.

Under this plan the official mailing list will be maintained by the Secretary. An addressograph is used in the Secretary's office. There the envelopes for mailing the *Journal* will be stamped. This can be done in advance and the envelopes as stamped should be accurate and correct. Under this plan the *Journals* may be placed in the mail within twenty-four hours after they are delivered from the printer.

I have heard that some members have failed to receive issues of the *Journal* to which they are entitled. I hope all division chairmen will ask anybody who falls into this classification to notify the office of the Archivist so back issues may be mailed.

Motion No. 36. Motion by Mr. Goetz, seconded by James C. Wilkes, that the report of the Archivist be accepted. Motion passed unanimously.

Report from Place and Date of Meeting Committee by J. Allen Tower, Chairman.

The *ad hoc* Committee on Place of Meeting Policy recommends that the Alabama Academy of Science meet in three out of each four years in the center of the state (Auburn-Birmingham-University triangle) and once in a more outlying location.

Motion No. 37. Motion by Dr. Tower, seconded by Dr. Bailey, that the report of the Place and Date of Meeting Committee be accepted. Motion passed unanimously.

Motion No. 38. Motion by Dr. Tower, seconded by Dr. Hanson, that the Executive Committee accept the invitation of Spring Hill College for 1961 and of Troy State College for 1962. Motion passed unanimously.

Report of the Councilor to A.A.A.S. by Father Yancey.

I attended the two business meetings of the Council on December 27 and 30, 1959, in Chicago.

Dr. Thomas Park was elected president-elect.

Six new societies were elected to affiliation in the A.A.A.S.

The Committee on Metric Usage made its report and was discharged.

The Committee on Council Activities and Organization made its report at the first meeting and this came up for extended discussion in the second meeting. The Council resolved itself into a Committee-of-the-whole for the discussion. Numerous amendments were made and rejected until it was finally accepted that the report would be accepted as a whole, except for discrepancies with the Constitutions and By-Laws of the A.A.A.S., which would be cleared up during the coming year. The Committee was continued for another year.

I was not able to attend the whole of the Academy Conference but I presented my report and also took part in a debate on whether Academies of Science should have permanent headquarters and obtain full time executive leadership. This was very interesting and brought out many different activities of state academies.

The 1960 meeting will be in New York, instead of Philadelphia.

Motion No. 39. Motion by Dr. Boschung, seconded by Father Twellmeyer, that the report of the Councilor to A.A.A.S. be accepted. Motion passed unanimously.

President Barker called for other items of Old Business and reports.

Report of Geology and Anthropology Section by Earl L. Hastings, Chairman.

As part of the program to increase participation in the Section, 188 mimeographed letters were mailed to geologists, mining engineers and

anthropologists in Alabama. Included with the letters was a questionnaire. The results of the 42 returned questionnaires were as follows:

	Favor Field Trips During Annual Meeting			Favor Separating of Geology and Anthropology Section		
	Do		Do Not	Do		Do Not
Members	22		3	19		4
Non-Members	11		2	13		1
No Opinion	—	4	—	—	5	—
Total	33		5	32		5

Those favoring separation of the Section did so with the reservation that both geology and anthropology should have enough members to function independently. As of January 31, 1960, 84% of the section membership were geologists. Therefore, the solution is either to greatly increase the anthropology membership so that it should stand alone or to combine anthropology with a closer allied section, such as Social Science.

To further study the prospect of separating geology and anthropology the Section Chairman will appoint a committee consisting of David DeJarnette, T. W. Daniels, Jr., and R. O. Shotts. The purpose of the committee will be to confirm the desire of the Section membership to separate and to recommend where an Anthropology Section could still function in the Academy.

About one month before the Annual Meeting date more than 200 mimeographed copies of the Geology and Anthropology Section program were mailed to geologists in Alabama.

This year the program has been expanded to both the morning and afternoon technical sessions and a half-day field trip with a guide book.

Sixteen geologists have been recommended for membership in the Academy by the Section Chairman in the last five months.

Motion No. 40. Motion by Dr. Tower, seconded by Father Eisele, that the report of the Geology and Anthropology Section be accepted. Motion passed unanimously.

Dr. Kenneth M. Gordon, Chairman, Section II—Chemistry, offered comment on Call for Papers. Dr. Barker brought out that it is the responsibility of the Section Chairmen to set up their section programs. General mailing from the Secretary's office announces Call for Papers with enclosed form for abstracts.

Mrs. Lucille N. Lloyd, Chairman, Section VII, Science Education, stated that Science Education Section members are too busy with Science Fairs and Junior Academy work to attend the Annual Meeting of the Section and to present papers.

Father Eisele, Vice-Chairman, Section V, Physics and Mathematics, raised the question as to whether or not the chairmen of the

section could solicit papers from nonmembers of the Academy. The President ruled that a chairman could do so.

Dr. Herbert Boschung, Editor of the Newsletter, stated that only one Newsletter was mailed this past year because there was not enough news reported. He requested that members send in news.

Dr. Tower suggested that the editor of the Newsletter appoint a news correspondent at each institution to send in news. A reminder might be sent to these correspondents one month ahead of mailing time requesting news.

President Barker called for New Business.

Motion No. 41. Motion by W. B. DeVall, seconded by Dr. Tower, that Article 1 of the By-Laws be amended to add the classification "Complimentary Membership." Persons entitled to such membership shall be sponsors of AJAS Chapters. The Permanent Counselor to the Junior Academy shall officially certify to the Secretary of the Academy by January 1 of each year those persons and their addresses entitled to such membership. Motion passed unanimously.

Motion No. 42. Motion by Dr. Tower, seconded by Mr. Goetz, that the meeting be adjourned. Motion passed unanimously.

Meeting adjourned at 11:25.

W. B. DeVall, Secretary

ANNUAL BUSINESS MEETING

Huntingdon College, Montgomery, Alabama, April 2, 1960

The meeting was called to order at 10:40 a.m. by Samuel B. Barker, President.

President Barker stated that the minutes of the 1959 Annual Business Meeting of the Academy had been mimeographed and mailed.

Motion No. 43. Motion by Dr. Carmichael, seconded by Dr. Tower, that the minutes be approved as printed in the *Journal*. Motion passed unanimously.

Report of the Secretary and Admissions to Membership Committee by Mr. DeVall.

The report that follows includes the major activities of the Executive Committee and officers of the Academy. The Fall Executive Committee Meeting was held at the University of Alabama Medical Center, Birmingham, in October. Twenty-six persons were present. The Spring Meeting of the Executive Committee was held at the Whitley Hotel,

Montgomery, Alabama, March 31, with thirty-four persons in attendance.

The Alabama Academy of Science and the American Association for the Advancement of Science have funds for support of research. Members are encouraged to encourage qualified applicants to apply for small grants to support qualified research activities.

The Executive Committee approved an increase to $2.00 of the registration fee for the 1960 Annual Meeting.

Committee Chairmen report that the Alabama Junior Academy of Science and the Alabama Science Fairs are operating efficiently and that their activities are coordinated in a strong science program.

The budget for the Alabama Junior Academy of Science was increased to $450 upon recommendation of the Permanent Counselor.

The State Coordinator of Science Fairs was granted an appropriation of $50 with which to conduct his program over the state.

Membership has been strengthened. No section has on its rolls less than 30 members. Two sections have more than 100 identified on their rolls. Additions to the Academy's membership during the past year have included:

67 individual memberships
1 life membership
1 associate membership
11 collegiate memberships
25 complimentary memberships

Five applications for membership are pending before the Admission to Membership Committee, making a total for the year of 110 if all are approved.

Two sections have been recognized for outstanding achievement during the year. Section III—Geology and Anthropology, chairmaned by Earl Hastings, and Section IX—Medical Sciences, chairmaned by Dr. Thomas Hunt have both been strengthened in terms of program and membership.

The Finance Committee was authorized to budget funds to the office of the Treasurer and Editor for fiscal year 1960-61.

The Executive Committee has approved amendments to the By-laws that would:

1. Change the fiscal and membership years to coincide with the calendar year.
2. Make only members in good standing entitled to receive a subscription to the *Journal*.
3. Add a new classification for membership—Complimentary Member; this category to include sponsors of Alabama Junior Academy of Science Chapters.

Editing of the "History of the Alabama Academy of Science" was placed in the hands of a committee consisting of Clyde Cantrell, Archivist, Samuel Barker, past President, and Paul Bailey, past Editor. It was recommended that the "History" be published as a supplement to the *Journal*.

Persons commended by the Executive Committee for past service to the Academy and its program were:

P. H. Yancey, A.A.A.S.
J. C. Wilkes, A.J.A.S.
Arthur Biendorff, Science Fairs
William Wingo, Science Fairs
Paul Bailey, *Journal* Editor

Motion No. 44. Motion by Mr. Goetz, seconded by Father Yancey, that the Secretary's report be accepted. Motion passed unanimously.

President Barker announced that upon the recommendation of the Admissions to Membership Committee and approval by the Executive Committee, Dr. E. B. Carmichael was approved for Honorary Membership. Dr. Carmichael was introduced to the audience.

Report of the Treasurer by Dr. Barrett.

The Treasurer reported that the balance carried forward at the beginning of the year was $3292.96. Receipts for the year totaled $2607.50, making the total funds $5900.46. Expenditures for the year totaled $2391.08, leaving a balance in the checking account, as of April 2, 1960, of $2009.38. On deposit in the savings account is $1500.00, A check in the amount of $50.00 was received from Mr. Sulzby with a request that it be applied toward the purchase of recognition cups for the Junior Academy of Science.

Motion No. 45. Motion by Mr. Goetz, seconded by Mr. Patton, that the report of the Treasurer be accepted and that the Secretary write a letter of thanks to Mr. Sulzby for his generous contribution. Motion passed unanimously.

Report of the Audit Committee by Dr. Boschung. Dr. Boschung submitted a statement signed by Robert W. Longley and E. J. Wheelahan which reads as follows: "We the undersigned Audit Committee have examined the financial records of the Alabama Academy of Science and have found them to be true and accurate."

Also submitted was a statement from Dr. James A. Kassner recapitulating the income and expenses of the A.J.A.S. for the period 1956-1959. This statement showed a balance on hand at the end of 1959 in the amount of $570.57.

Motion No. 46. Motion by Dr. Tower, seconded by Father Eisele that the report of the Audit Committee be accepted. Motion passed unanimously.

President Barker announced that Dr. J. C. Wilkes has resigned as Permanent Counselor to the Junior Academy. He cited Dr. Wilkes, Mr. Patton and Mr. Boozer for their unselfish service to the Junior Academy.

Motion No. 47. Motion by Dr. Boschung, seconded by Dr. A. T. Hansen, that Mssrs. Wilkes, Patton, and Boozer be commended for their service to the Junior Academy. Motion passed unanimously.

Report of the Nominating Committee by Dr. McCullough. "The Nominating Committee, consisting of Patrick H. Yancey, Dr. Winkler, and Dr. H. A. McCullough, Chairman, submits the following slate of officers for the Academy for the ensuing year."

[*The list of officers here named is published as a separate item, beginning on page 320.*]

Motion No. 48. Motion by Dr. Tower, seconded by Dr. Carmichael, that the nominees be elected to their respective offices and that the Secretary cast a unanimous ballot. Motion passed unanimously.

Report of the Place of Meeting Committee by Dr. Tower.

The Executive Committee has approved the recommendation that the Academy meet for three out of four years in the center of the state and once in a more outlying location. The next Annual Meeting (1961) is recommended for Spring Hill College, Mobile, and the next (1962) for Troy State College.

Motion No. 49. Motion by Mr. Cantrell, seconded by Father Twellmeyer, that the report be accepted and that the Academy make plans to hold its 1961 meeting at Spring Hill College. Motion passed unanimously.

President Barker asked Father Yancey to comment on the invitation submitted by Spring Hill College. He stated that Father A. F. Hemphill will serve as Chairman of Local Arrangements for the Academy and that Father Twellmeyer will serve as Chairman of Local Arrangements for the Junior Academy.

Report of the Resolutions Committee by Mr. Goetz.

The Resolutions Committee, consisting of Dr. Roland Harper, W. B. DeVall, and James R. Goetz, Chairman, submits herewith the following resolutions:

(1) Whereas the success of this, the 37th Annual Meeting of the Alabama Academy of Science has been enhanced and largely made possible by the hereinafter mentioned, be it therefore resolved

  (a) That the Academy express its appreciation for the hospitality of Huntingdon College and its president, Dr. Searcy.

  (b) That the Academy recognize and express its special appreciation for the excellent work of Mr. Charles C. Turner, Jr. and his associate members of the Local Arrangements Committee.

(c) That continuing gratitude be expressed for the hospitality of the Birmingham Division of the E. H. Sargent & Co. in furnishing the annual banquet.

(2) Whereas, since the last annual meeting, several careers and loyal, valuable services to the Academy have been terminated by death, now, therefore be it resolved that the Academy extend its sympathy to the families of Dr. Tom D. Spies, Dr. Stuart J. Lloyd, Dean Joshua E. Hannum, and that copies of this resolution be sent to them and be spread upon the minutes of the Academy.

Motion No. 50. Motion by Dr. Carmichael, seconded by Dr. A. T. Hansen, that the report of the Resolutions Committee be accepted and that the Secretary notify the families of the deceased members of the action of the Academy. Motion passed unanimously.

Dr. Harper spoke briefly on the accomplishments of Dr. S. J. Lloyd, deceased. Mr. Cantrell suggested that a future issue of the Journal of the Academy might be dedicated to Dr. Lloyd. The Editorial Committee was asked to consider this possibility.

Dr. Carmichael spoke briefly regarding the opportunities that members have through Academy membership to support and strengthen the science programs of the state. He urged more active support of the Academy through member participation. It was suggested that solicitation of papers from a larger portion of the membership would enhance attendance at the Annual Meeting.

Dr. Chastain recommended that the Executive Committee consider ways and means of indoctrinating the vice-presidents of the sections. It was pointed out that the Executive Committee, which includes the vice-presidents, might devote some time on its agenda for the Fall Executive Committee Meeting to a discussion of responsibilities.

President-Elect Goetz took office as President. He stated briefly that his goals during his year of tenure would be:

(1) To strengthen membership
(2) To seek endowment financing of the Academy
(3) To explore ways of extending the Academy's interest and program to industry
(4) To give the Academy more adequate publicity.

Motion No. 51. A motion to adjourn was made by a majority of those in attendance and seconded by all present. Motion passed unanimously.

W. B. DeVall, Secretary

ALABAMA ACADEMY AWARD—1960

The Alabama Academy of Science made a double presentation of the Academy's Award to Outstandng High School Science Teachers at the 37th annual meeting of the Academy in Montgomery, Alabama. Recipients of the citations and gold pins were Mrs. Pauline K. Long of Woodlawn High School, Birmingham, and Brother Cyr, S.C. of McGill Institute, Mobile.

The award is given annually to a high school science teacher for meritorious teaching of science. The purpose of the award is to recognize those teachers who go beyond the classroom to stimulate scientific endeavor among their students. This is the second time in the history of the Award that a double presentation has been made.

Mrs. Long has been an outstanding teacher in the State since 1938. Most of her teaching career has been spent in the Birmingham area, having taught at Leeds High School, Phillips High School and Shades Valley High School, as well as Woodlawn High School.

Mrs. Long was born in Tennessee but received her early education in the Birmingham schools. She was awarded her B.S. from Birmingham-Southern in 1935 and her Masters degree from the University of Chicago in 1940. Her later studies took her to Massachusetts Institute of Technology, the University of California, the University of North Dakota, and Florida State University.

In addition to her teaching duties, Mrs. Long is a busy mother of four children. Her husband, R. W. Long, is a Birmingham real estate agent.

Although coming to Alabama only five years ago, Brother Cyr, S.C. has compiled an enviable record through his energetic leadership of students at McGill Institute. Brother Cyr was born in Bayonne, New Jersey, where his parents still reside. His elementary and high school years were spent in New Jersey. In addition to receiving his B.S. degree from Loyola College, New Orleans, Brother Cyr will be awarded his Masters degree by Notre Dame this summer. He has also studied at Louisiana State University.

Brother Cyr's teaching duties have been carried out in New York, New Jersey, Canada, and Louisiana before coming to Ala-

bama. After receiving his Masters degree this summer, he will return to New Jersey to continue his life as a Brother of the Sacred Heart in the Northern Province. While at McGill Institute, he has been very active in all phases of science, serving as head of the Physics Department at the school, Sponsor to the McGill Chapter of the Alabama Academy of Science, and President of Mobile Academy of Science.

James L. Kassner, Professor of Chemistry, University of Alabama, made the presentation Friday evening, April 1, at the joint banquet of the Senior and Junior Academies of Science.

GORGAS SCHOLARSHIP FOUNDATION

Report of the Scholarship Committee—1958-59

The annual Alabama State Science Talent Search completed its seventh year under the sponsorship of The Gorgas Scholarship Foundation, Inc. The winners from the white high schools were announced at the annual meeting of the Alabama Academy of Science on March 12 at Alabama Polytechnic Institute at Auburn. The winners from the Negro high schools were announced at Southern Research Institute on May 23, 1959.

Eighty-one seniors representing twenty-nine white high schools (public and private) in the State of Alabama, completed the aptitude examination which was conducted by the Science Clubs of America, and administered by Science Service for the Westinghouse Science Scholarships.

Of these students, twelve were selected as Finalists and invited to appear before a board of judges during the annual meeting of the Alabama Academy of Science. These twelve finalists were personally interviewed by the Scholarship Committee on March 12, 1959. The winners were announced at the annual banquet of the Alabama Junior Academy of Science by Dr. Emmett B. Carmichael, Chairman, The Gorgas Scholarship Foundation.

	Name	High School
1st award	Paul N. Kirk	Sidney Lanier
2nd award	Charles M. Chambers	Huntsville
3rd award	Gordon S. Johnson	Decatur
4th award	George C. Kinzer	Demopolis
1st alternate	Alvin D. Moore	Shades Valley
2nd alternate	Erle D. Murphey	Shades Valley
3rd alternate	Joseph W. Lewis	Phillips
4th alternate	Robert L. Balisok	Huntsville
5th alternate	Lawrence H. Pierce	Robert E. Lee
6th alternate	Glenn J. Ahrenholz	Tuscaloosa
7th alternate	Virginia L. Johnston	Ramsay
8th alternate	William S. Jordan	Fairhope

Twenty-six seniors representing seven Negro high schools in the State of Alabama completed the aptitude examination which was conducted by the Science Clubs of America, and administered by Science Service for the Westinghouse Science Scholarships.

Of these students five were selected as finalists and were invited to the Southern Research Institute for an interview by the judges on Saturday, May 23, 1959. Only three finalists appeared for the interview.

The Negro finalists were interviewed by the Scholarship Committee on May 23, and the winners were announced that afternoon.

	Name	High School
1st award	Lillian R. Boykin	Fairfield Industrial
1st alternate	Willie T. Anderson	Fairfield Industrial
2nd alternate	Myranell J. Green	Parker

Judges

B. W. Arthur
W. H. Bancroft, Jr.
Robert E. Burks
Emmett B. Carmichael
Charles E. Feagel
K. M. Gordon
F. E. Guyton
Arthur Hall, Jr.
C. C. Hall, Jr.
Thomas I. Hicks
Gordon Hughes
J. E. Land
Frank Locke
Robert D. Weigel
Harold E. Wilcox, Chairman
W. S. Wilcox
Ernest Williams
R. E. Wingard
W. J. Wingo
James W. Woods

FINALISTS IN THE ALABAMA STATE SCIENCE TALENT SEARCH, 1959

White Contestants	College Attending	Scholarship	Major
Paul N. Kirk	Princeton University	Princeton National $2,000 per year—4 years	Physics, Math
Charles M. Chambers	University of Alabama	Gorgas Award $3,000 per year plus tuition	Electrical Engineering
Gordon S. Johnson	University of Indiana	Merit Fee Remission	Biology
George C. Kinzer	Auburn University	Gorgas Award $225 per year plus tuition	Physics
Alvin D. Moore	University of Alabama	Gorgas Award $150 per year plus tuition	Aeronautical Engineering
Erle D. Murphey, Jr.	(Now serving with the U.S. Army)		
Joseph W. Lewis, Jr.	Birmingham-Southern	Gorgas Award $125 per year plus tuition	Pre-Medical
Robert L. Balisok	University of California	U.C.L.A. Scholarship at end of first semester	Biophysics
Laurence H. Pierce	Huntingdon	Honor Scholarship $100 per year	Engineering
Glenn J. Ahrenholz	University of Alabama	None	Civil Engineering
Virginia L. Johnston	Howard	Linley Heflin $250 per year plus a tuition scholarship from Howard	Pre-Medical
William S. Jordan	Vanderbilt University	None	Pre-Medical
Negro Contestants			
Lillian R. Boykin	Tuskegee Institute	Gorgas Award $300 per year plus tuition	Biology
Willie T. Anderson	(Now serving with the U.S. Army)		
Myranell J. Green	Michigan State University	Sixth Ave. Baptist Church $100	Medical Technology

THE ALABAMA JUNIOR ACADEMY OF SCIENCE

Proceedings of the Twenty-Sixth Annual Meeting

Huntingdon College, Montgomery, April 1-2, 1960

The caucus of officers, official delegates, and nominees for office was called to order by the President, James Jones, at 10:30 a.m. in Bellingrath Hall. Mrs. Lucille N. Lloyd, Sponsor for the Mobile Region, was present. The schools attending this convention were:

High School	Official Delegate
A. G. Parrish	Billy Bishop
Baldwin County	Sam Ruple
Bishop Toolen	Angela Mallini
C. F. Vigor	Dicky Bass
Choctaw County	David Parten
Coffee	Bill Barnwell
Ensley	Allyn Spence
Foley	Bruce Dyer
Fairhope	Richard Winburg
Fort Payne	Johnny Newsome
Huntsville	John Thornton
John Carroll	William McDermott
Julius T. Wright	Peggy Smith
Marion Institute	K. F. Weikert
McGill Institute	James McAleer
Mercy	Elizabeth Murphy
Minor	Donnis Whitfield
Montevallo	Gisela Molgedi
Murphy	Tommy Lappage
Robert E. Lee	John Ellis
School of Organic Education	Monita Gooden
Semmes	John Aldridge
Shades Valley	Carol Conniff
Sidney Lanier	Louis Wilson
S. R. Butler	Reva Johnson
St. Bernard	Clark McAfee, Jr.
Tallassee	Darryl Haynes
Theodore	Ann Fagerstrom
Tuscaloosa	George Hamner
West End	Herbert Chaffin
Woodlawn	Eleanor Long
Sylacauga (given new charter)	Howard Cockerham

Other high schools which were given charters as new chapters were Childersburg, Emma Sansom, Eufaula, Gadsden, Geneva,

Mobile County, Oxford, Munsford, Pell City, Samson, Slocomb, Sylvania, Auburn, and Anniston. None of them was present at the convention.

The Secretary called the roll. The President asked that, as the minutes of last year's convention were sent to each school after the convention and in September, we dispense with their reading. This was unanimously accepted. James then read the list of schools to be given new charters. The candidates for office were then asked to leave the room.

Each of the nominees was brought in individually to speak in his own behalf after James had given a brief run-down of his qualifications. Ann Fagerstrom of Theodore asked that the name of each candidate be written on the board as he came in.

James cited several of the rules governing the campaigning for office, while the Vice-President and Secretary counted the votes. The following slate of candidates was selected:

President	William McDermott, John Carroll High School Jeanette Lyles, Semmes High School
Vice-President	William Harmon, Hueytown High School Paul Schultz, Foley High School
Secretary	William Cork, Minor High School Lynda Persson, Murphy High School
Treasurer	Elina Tyrell, Mercy High School William Holland, Shades Valley High School

Eric asked that the two candidates for vice-president meet with him after the caucus. James explained that these candidates, Eric, and other chosen people would constitute the Resolutions Committee. Eric explained that the purpose of this Committee is to pay tribute to those people who helped with local arrangements.

Each of the nominees for office was given a ribbon to wear until the election.

The 1:30 p.m. business meeting was held in Flowers Hall. The President called the meeting to order and asked that all official delegates come to the front of the auditorium. The Secretary called the roll. The names of schools to be given new charters were read and these schools were asked to get their charters. James announced that each club having an exhibit must have a representative from the club present during the judging. James then introduced Dr. Wilkes who made several announcements concerning recreational facilities for the afternoon and the banquet for

that evening. He also emphasized the announcement James had made concerning the exhibits.

Eric announced that the following would be on the Resolutions Committee, which would meet immediately following the business session: Chairman—Eric Revere, McGill; Co-Chairmen—Ray Wade, Semmes; Paul Schultz, Foley; William Harmon, Hueytown; Howard Cockerham, Sylacauga; Sponsor—Brother Cyr, Mobile.

The candidates for office and their campaign managers gave their campaign speeches.

As there was no further business, the meeting was adjourned until 8:30 a.m. Saturday, in Flowers Hall.

The annual banquet of the Alabama Academy of Science and the Alabama Junior Academy of Science was held in the Blue-Gray Room of the Whitley Hotel at 7:00 p.m. Both Dr. Sam B. Barker, President of AAS, and James Jones, President of AJAS, gave presidential addresses. Dr. E. B. Carmichael announced the Gorgas Scholarship winners. Dr. James Kassner presented the Outstanding Science Teacher Award to Mrs. Pauline Long of Woodlawn High School. This same award was presented also to Brother Cyr of McGill High School.

Following the banquet, the Junior Academy enjoyed a party in the State Room of the Whitley Hotel.

At the 8:30 a.m. general assembly on Saturday, April 2, the President announced the winning regional papers, which were then read by their authors. *[The names of the regional winners and the titles of their papers are given on page 350.]*

Following the reading of the papers, James called a ten-minute break before the business meeting.

James Jones called the 9:00 a.m. business meeting to order. He asked that all official delegates come to the front of the auditorium. He announced that the Executive Committee luncheon would be held in the Student Center Building rather than at the Whitley Hotel. He then read the list of nominees for each office and asked that each nominee stand as his name was called. Eric Revere and Paul Schultz distributed and collected ballots.

While the votes were being counted, Paul Schultz gave the Treasurer's report:

As Treasurer of the Alabama Junior Academy of Science for 1959-1960, I submit the annual report:

Dues collected	$126.00
Regional dues	30.00
Membership cards sold	3.65
Total receipts	$159.65
Expenditures—stamps, overcharge, etc.	8.00
Balance brought forward	$151.65

Eric Revere, as Chairman of the Resolutions Committee, then submitted the following statement:

Be it resolved that the Alabama Junior Academy of Science go on record as follows:

We express our sincere thanks to Dean Charles Turner, Dean of Students, who as Counselor of Local Arrangements for both Academies, with the help of other members of the Huntingdon College faculty, has made our visit most enjoyable; to the Robert E. Lee High School Science Club of Montgomery, whose members and sponsor, Mr. Price, have assisted in the very smooth operation of this convention; and to Dr. Gid E. Nelson, Chairman of Judging, and his corps of judges, who did a thorough job.

In a marked manner we render our gratitude to the following persons for their time and effort displayed in our behalf: Rev. George O. Twellmeyer, State Coordinator of Science Fairs; Dr. James L. Kassner, State Coordinator for Science Clubs of America; Mr. Reuben B. Boozer, Associate Counselor (who due to the death of his father could not be present with us today); and to Dr. Emmett B. Carmichael, Chairman of the Gorgas Scholarship Foundation, Inc.

We especially thank the members of the Senior Academy and Dr. Sam B. Barker, President, who made our joint banquet a very enjoyable occasion.

We extend thanks to Mr. Gene Reeder, who furnished entertainment and music at our much-enjoyed party.

A special tribute of gratitude is extended to Dr. James C. Wilkes, Permanent Counselor, who with unstinted generosity, has served the organization during the fall executive meeting, during this convention, and during the entire year; to our President, Mr. James Jones, his capable officers, and their sponsors, who carried this convention along rapidly and most successfully; and to the management of the Whitley Hotel who made our stay most privileged and comfortable.

A copy of the resolutions will be sent to each person and staff mentioned.

Dr. Wilkes presented a certificate to each of the officers.

James Jones then announced the new officers for 1960-61, in reverse order. These officers are as follows:

President—Jeanette Lyles, Semmes High School
Vice-President—Paul Schultz, Jr., Foley High School
Secretary—Lynda Persson, Murphy High School.
Treasurer—Elina Tyrrell, Mercy High School.

Dr. Wilkes presented the awards to the officers and announced there would be an Executive Committee meeting following the business meeting, in the Student Center Building.

Jeanette Lyles, the new President, adjourned the meeting.

The Executive Committee met in the Student Center Building immediately following the business meeting. Those present were Dr. James C. Wilkes, Richard O. Tatum, Sister Mary Robert, R.S.M., Elina Tyrell, Paul Schultz, Glenda Brown, Lucille N. Lloyd, Clyde J. McSpadden, Brother Cyr, S.C., Clustie McTyeire, Mary E. Ward, G. O. Spencer, Claudia Smith, Jeanette Lyles, Lynda Mia Perrson, James R. Jones, and Eric D. Revere.

Dr. Wilkes asked for clarification of the awards and cash prizes for the winning exhibits and papers. He also asked Glenda Brown and Eric Revere to submit statements for their bills.

James gave Dr. Wilkes the extra officers' ribbons to be used next year. He also gave a brief explanation of the duties ahead for the officers. Dr. Wilkes asked that the old officers be sure to transfer the records to the new officers.

Dr. Wilkes stated that the financial condition of the Junior Academy was sound. He asked that the new Secretary have each region report to Paul Schultz concerning regional dues.

Dr. Wilkes asked that the Executive Committee compose a statement to be sent to the sponsors regarding the conduct of some of the students at the Whitley Hotel. Mr. Tatum made a motion that any chapter which was out of order (with the Executive Board defining out of order) be barred from the convention for one year. With the insertion that the school be first put on probation, the motion was unanimously accepted. It was strongly recommended that positive proof be presented before any action be taken against any chapter.

The Senior Academy and the Junior Academy met jointly for the 11:00 a.m. business session. Eric Revere, Vice-President of the Junior Academy, presided.

He introduced Dr. Wilkes, who introduced the Regional Sponsors:

Mobile Region—Mrs. Lucille Lloyd, Barton Academy
Southeastern Region—G. O. Spencer, Troy State College
North Central Region—Miss Clustie McTyeire, Hueytown High
Northeastern Region—Harold S. Strickland, Jacksonville State

The Sponsors introduced the presidents of their regions, who gave a brief history of each region. All reported progress.

Eric Revere thanked the sponsors and these officers for their work in the scientific field.

Eric then introduced Dr. Sam Barker, President of the Senior Academy, who presented his farewell address entitled, "Science Deserves a Distinguished Place in Education as the Core of Education."

Dr. Barker then introduced Dean Volker who spoke on, "What the Student Can Expect in College and Graduate Work."

Dr. Wilkes announced the winners of the exhibits and papers and presented the awards. These were as follows:

Chemistry Exhibits

First place (10" cup)	McGill Science Club—Colorimetric Analysis
Second place (8" cup)	Choctaw County Chapter of AJAS—A Study of Water Samples
Honorable Mention	John Carroll Science Club—Geology of Red Mountain

Physics Exhibits

First place (10" cup)	Opp General Science Club—Electronic Clock
Second place (8" cup)	Woodlawn Science Club—Fish Talk
Honorable Mention	Butler High Science Club—Semiconductors

Science in Industry Exhibits

First place (10" cup)	West Endventors, West End High School—Calculating with Electric Current
Second place (8" cup)	Fiat Lux Science Club, Coffee High School—Aluminum Reduction Cell
Honorable Mention	Baldwin County Science Club—Manufacturing of Paper by Sulfite

Biology Exhibits

First place (10" cup)	Ensley Science Club—The DNA Molecule
Second place (8" cup)	Abbe LeMaitre Science Club, Bishop Toolen High School—Jubilee
Honorable Mention	Montevallo High School AJAS—A study of the Correlation Between the Number of Defective Teeth and Frequency of Sweets Consumed

Papers

First place (10" cup)	Eleanor Long, Woodlawn High School, "Experiments in Twentieth Century Problems."
Second place (8" cup)	Victor Grimes, Huntsville High School, "A Space Laboratory."
Honorable mention	Peggy Gibson, A. G. Parrish High School, "Termite Differentiation."

The American Association for the Advancement of Science Awards were presented to:

Girl: Jeanette Lyles, Semmes High School; Miss Mary Ward, Sponsor.
Boy: Billy Bishop, A. G. Parrish High School; Mrs. Ruby Countryman, Sponsor.

Dr. Sam Barker adjourned the meeting.

ALABAMA JUNIOR ACADEMY OF SCIENCE EXHIBITS

(Title, school, and sponsor listed in that order)

Chemistry

Geology of Red Mountain	John Carroll High School, Sister Mary Leo, O.S.B.
Study of Water Samples	Choctaw County High School Mrs. Wyman O. Gilmore
Effect of a Catalyst on Rate of Reaction	Hueytown High School Miss Edith Geisler
Colorimetric Analysis	McGill Institute Brother Cyr, S.C.

Physics

Bindic	A. G. Parrish High School Mrs. Ruby Countryman
Electronic Clock	Opp High School Mr. Lloyd M. Crook

Fish Talk	Woodlawn High School Mrs. Estelle Jackson
Semiconductors	Butler High School Mrs. Ibbie K. Bradford
Ballistics and Free Fall	Mercy High School Sister Mary Robert, R.S.M.
AC-DC Rectifier Board	Robert E. Lee High School Mr. Jessie L. Price
A Space Laboratory	Huntsville High School
High Speed Photography	Murphy High School Mr. W. W. Fulcher
A Model Wind Tunnel	Fort Payne High School Mr. B. V. Noles

Science in Industry

Aluminum Reduction Cell	Coffee High School Mr. E. G. Dorris
Manufacture of Paper by Sulfite	Baldwin County High School Miss Leillian Leonard
Measuring with Electric Current	West End High School Miss Mary E. Hafling
The Principle of Infra-Red Guidance	Marion Institute Mr. R. L. Trawick

Biology

A Study of the Correlation Between the Number of Defective Teeth and the Frequency of Sweets Consumed	Montevallo High School Miss Ethel Harris
Jubilee	Bishop Toolen High School Sister Mary Lois
A Study of Cancer	Foley High School Mr. Clyde J. McSpadden
Red Gold	Semmes High School Miss Mary E. Ward
Alternation of Generations Exemplified by Hairy Cap Moss	Dora High School Miss Dorothy S. Ellison
Human Circulation	St. Bernard High School Rev. Gerald Bray

REGIONAL SCIENCE FAIR EXHIBIT WINNERS

Mobile Region

Jack Crowell Murphy High School	Zeus I
Ann Fagerstrom Theodore High School	Formation of Digital Root Squares

North Alabama Region

David Wilson Tuscaloosa High School	Living on Mars
Linda Darwin Smith Coffee High School	Development of a Chick

North Central Alabama Region

Wynne Alexander Tuscaloosa High School	Plant Tropism
Norman McCoy, Jr. Ramsey High School	Scientific Photography

Northeastern Alabama Region

John M. Cone Anniston High School	Title not available
Omer Lee Burnett Sylacauga High School	Carbon-14 Counter

Southeastern Alabama Region

William Cargile Lanier High School	Digital Classification of Words for Coding and Decoding
Katherine Kampe A. G. Parrish High School	Natural Selection in Bacteria

Respectfully submitted,

Glenda Brown

Secretary of AJAS

SCIENCE AND PUBLIC POLICY

GEORGE HUDDLESTON, JR.

Member of Congress, Ninth District of Alabama

[*Editor's Note: This article reached the editor through Dr. Ward Pigman and Dr. Paul C. Bailey. Both suggested that it expressed views of general interest to all scientists and hence, should be suitable for publication in the Journal. This issue is mainly concerned with reporting the general affairs of the Academy. So, it seemed to be an appropriate issue for Representative Huddleston's statement to appear.*]

Much as technology has determined political power among nations in the first half of the twentieth century so will scientific research—both pure and applied—determine it hereafter. Those Americans, whether in or out of public office, who failed to recognize the political impact of scientific advances, must certainly have been brought up short by the events of October 1957, and have been even more amazed by the subsequent adventures into space.

We may try, as one official did, to dismiss the launching of Sputnik as "a mere bauble." But in more sober moments, we have come to understand its true meaning: The nation which allows itself to be out-distanced in the quest for scientific knowledge must, like the French at Crecy, soon face up to the harsh realities of political power in a new era.

Like it or not, political power is becoming evermore dependent upon scientific knowledge. An almost frantic search for power through science led to revolutionary discoveries, which seemed ultimate, but which we now know to be only the signs of things to come. Utilizing this new-found knowledge, man's scientific capability is gathering momentum like a rolling snowball on a mountainside that threatens to become an avalanche engulfing us all.

One of the great problems we face in this connection is the difficult task of keeping our scientific advances and our governmental course of action fully coordinated and in harmonious balance. Another problem, integrally related to this and of equal importance, is how to insure that both our scientific advances and our public policies come within the scope of general comprehension by our citizenry.

This problem was presented clearly in the report of the Interim-Committee on the Social Aspects of Science of AAAS and

was the basis for much discussion at the 1958 Parliament of Science. This initiative on the part of scientists was very helpful and undoubtedly did much to catalyze future events, such as the appointment of the President's Science Advisory Committee and the reactivation of scientific advisors by the State Department.

Science and Government Once Mutually Isolated

We must remember that after the period of active collaboration between scientists and the government during World War II, mainly through OSRD, the presidents, Democratic and Republican, became almost isolated from the scientific community. Perhaps this situation arose, at least partially, because the newly founded National Science Foundation considered its role to be that of a passive advisor and administrative agency rather than an active advisor at the presidential policy-making level. The scientific organizations of the country also made few or no efforts to present the facts and necessities to either the public or the government. Can it be that they were not aware of the situation? Were they not acquainted with the nature of our democratic processes and the need for informed groups and persons to express their opinions?

The current council of science advisors is on trial. Will it provide an effective line of communication between policy makers and persons with the scientific and technical knowledge that is needed for many decisions? Only experience will show whether it is successful or becomes another sterile and unused body.

Certainly, even during this trial period, scientists and engineers should debate the need for a Federal Department of Science. Even if opinion is divided, the consideration will clarify many issues, and congressmen would like to know the extent of division of opinion as well as the reasons.

Neither scientists nor the government, whose power and perhaps whose life today rests so heavily on scientific endeavor, can afford to ignore the people or society in general, any more than they can afford to ignore each other.

The Role Of Science

What can science and government do to complement one another and to get their message, whether separate or joint at a particular moment, over to the American public?

As for science, it should "organize." As important as it is today in all aspects of American life—and I feel fully justified in

emphasizing and re-emphasizing this fact—science generally has as little and as ineffective a public relations service as can be found among any of the economic, social, industrial, or professional groups of our land. Its "organizing," incidentally, should be in the nature of a public relations enterprise rather than along lines of a labor union, and should include career-minded persons. Scientific organizations must now deeply analyze their social role and not solely rely on their historical functions.

And what is the public's need for a professional organization with a co-ordinating voice for the field of science? The most obvious reason, of course, is simply to get across the broad views of science and scientists to the public. In this age of fierce competition of ideas and under our system of free access to the public mind in order to convince us that one product, one theory, or one platform is the best, science must not fall behind business, labor, and other groups in making itself heard. The AAAS could assume much of this leadership.

Specifically, organized science could, for example, broadcast its need for specially trained personnel to a far greater degree than is currently being carried out.

It could—and indeed should—wage a campaign to woo public respect. Scientists, and scholars generally, must shake off the unfair and meaningless stigma of "eggheadism." Academic defense of this characterization has not been, and probably cannot be, a deterrent to such thinking—or perhaps I should say "nonthinking"—among large segments of our people. Fortunately, however, the time is ripe for the conversion of skeptics and "regular folks" to the normalcy of things scientific and of those who think in scientific terminology. In short, an imaginative campaign on the part of organized science could do much.

Organized science might be able to correct an injustice that occurs when the public lauds and the government decorates a single individual or very small group for an achievement that is the product of a very large group. I fear that we, as Americans, do not stop to contemplate sufficiently the fact that every finished marketable scientific product results from an enormously extensive effort wherein many scientists, working from the whole accumulated knowledge of science, may have to test thousands of formulas or products before the desired ends are achieved. The public should be encouraged to realize the devious and involved nature of scientific research. The scientist, unlike the cabinet maker, has to create his tools and start with a tremendous mass

of past work before he can begin to work on a particular project. Abstract basic science must be accorded greater understanding and must receive a more proportionate share of the limelight when a remarkable scientific product is placed before the world.

Scientists should, finally, use their organizations to express the needs of science, if not to make its demands, directly to the government.

The Role Of Government

To a large degree, the advancement of science is dependent on government. Only the public treasury can support vast nationally important projects that are so vitally needed. Never would our nation have been able to develop the atomic bomb during World War II without a concerted government-sponsored program, the gigantic Manhattan project. The role of government is now even more important. It has become imperative for national security that we concentrate on building ballistic missiles, earth and moon satellites, and space exploratory vehicles. With each major break-through, the way is cleared for other startling undertakings. The cost and complexity of these projects demand unified scientific programs.

Indeed, in the not too distant future, it may become necessary for the free nations of the world to combine their scientific resources in the never-ending quest for technological advantage. While our scientific efforts, traditionally supported by private enterprise, have been aimed at improving the general well-being of all mankind, other nations have been at work only in the hope of achieving technological domination of the world. We are, to be sure, now involved in a "science race" much more frightening than any international arms race.

Despite its having advanced in stature from an incidental to a fundamental force within a relatively short time, science still occupies a position, in its relationship with government, which is purely advisory. This should not be; science should have more than merely a "staff responsibility" in federal government, offering only recommendations for possible consideration.

Rather, science should occupy a "line position," exercising some degree of command to insure that our scientific potential is fully developed. Only by giving science some authority in government, and making it responsible to the people through the Congress and the President, can we maintain the relationship which is both necessary and proper.

Intelligent organization and planning control on a national level is needed to eliminate unnecessary waste of valuable time and money. To encourage research, the government need offer appropriate incentives to attract and keep scientists in the laboratory, governmental and elsewhere. The federal support of science should be on a well-planned, coordinated, and orderly basis.

One of the larger problems of government support of science is the project system. The real need is for funds to be allocated to a broad field of research for an extended period rather than to closely restricted projects. In the field of basic research, the scientist is usually unable to tell from one month to the next what course of research will lead to the most productive results. The project system causes researchers to disregard original project plans or else it leads to a sterile type of research which may produce scientific papers but does not solve real problems. The current progress in this direction by the Public Health Service, the National Science Foundation, and the Office of Naval Research is to be commended and should be copied by other agencies.

All this is not to deny the need for private enterprise to continue, with its gigantic research facilities and its monetary resources, to support scientific advance. Free enterprise has made our nation great and it should certainly be fully utilized at this time in this area. Methods for increasing private support should be sought.

An example of particular federal action which would advance the cause of science in this country might be the creation of a clearing house for world-wide reports of completed and current scientific research. Many excellent American abstracts organizations, especially in the field of chemistry, are already in existence. However, these organizations, expanded to serve all phases of science, would be of great value to every scientist. Although some progress has been made, further intensive efforts may be required with the rapid increase in the number of publications. The existence of "vested interests" in this field may be countered by direct support from the government, with general coordination from the National Science Foundation.

A very basic problem exists in the financing of scientific journals in which the research going on in our own country is reported. The present situation causes difficulties to scientists who wish to publish their research results. With the current flood of research support, extensive delays in publications can result and duplication of scientific effort is possible. Considerable relief in this sit-

uation might be provided if the National Science Foundation set aside as much as five per cent of its appropriations for grants in support of abstracting services and scientific journals.

Government Should Proceed Carefully

The federal role must be only to encourage and assist science, not to control it. Science, in its relationship with government, should neither be in a position like that of a pampered and demanding mistress nor that of a well-heeled slave.

In truth, as little federal control as possible is to be desired. To aid science effectively the government should lay down broad scientific programs, furnishing general guidelines and setting up certain priorities but allowing wide latitude in research activities. While duplication of effort is to be avoided, the problem is never as serious as non-scientists may believe, and the screening for "duplication" should not be made a fetish as it may be in many government laboratories. Wide discretion must also be given research scientists and institutions on how to go about solving each problem. In short, the federal responsibility should be to insure that our scientific abilities and resources are put to the most feasible uses, that our creative efforts are channeled generally toward common goals of national importance, and that the most pressing problems are met in the shortest possible time.

In encouraging scientific development we should take care to avoid the pitfalls of overcentralization. We must never sacrifice our democatic form of government, under the guise of protecting it, by imposing controls over scientific endeavor or scientific thought. The public policy in regard to science must, therefore, be extremely prudent rather than rampantly expedient. The scientist's freedom, like that of us all, must be completely guaranteed.

Role Of The People

Still, to paraphrase Clemenceau, science is too important to be left in the hands of the scientists alone. Right now, science is entering a new phase of technological development which threatens to dwarf the individual. Only the government, representing the people as a whole, is in a position to cope with the situation, thereby serving the best interests of the people as individual citizens. Here again, the people must themselves direct the government as to how they shall be represented.

Thus, in order for us to maintain a free society, a closer relationship between science and government has become mandatory.

Likewise, the changing role of science gives new importance to the role of public opinion. The impact of public opinion on public policy, like that of science, is now more keenly felt. There is consequently more need for an enlightened public to exert a positive force on government in the scientific interest. Because in a democracy government must be responsible to the will of the public, an educated populace is essential to the future of our way of life.

Need For Greater Educational Effort

Education is also the basis for the advancement of science. Without more and better trained scientific, engineering, and other professional manpower, science cannot hope to forge ahead. Our educational program, while stressing the importance of technical studies, should never neglect the humanities. There is need for all types of scholars. The quality of our education in general must be improved in order to aid science in particular.

In the Soviet Union, the state-controlled system of education is turning out scientific and technical graduates in numbers which our nation is not matching. The whole Soviet education structure is geared to the research and development needs of the Kremlin. And frighteningly enough, Russian scientists have demonstrated that science and technology can flourish in a totalitarian state.

Our principle hope, then, in this struggle for technological supremacy, is that American creativeness and ingenuity in the field of science—aided substantially by forward-looking government, fostered actively by scientific organizations, and approved and supported by a vigorous and enlightened populace—can overcome the Soviet Union's blind race for power.

INSTRUCTIONS FOR CONTRIBUTORS

Editorial Policy:

Papers and abstracts of papers to be published in the Alabama Academy of Science Journal may be submitted by both Academy and non-Academy members at any time during the year. Priority, however, will be given to material submitted by members of the Alabama Academy of Science.

Full-length papers which are submitted for possible publication will be judged by a review board on the basis of original data presented and upon the interpretation or review made of the materials presented within a limit of 15 printed pages. An article exceeding this limit will be charged at the rate of $10.00 per additional page. Papers must be submitted solely to the Alabama Academy of Science Journal and must not be reprinted in another publication without the consent of the editor.

Manuscripts:

The manuscript should be typed double spaced allowing good margins. Captions and legends for figures should be typed on sheets separate from the text. Footnotes are not desirable and should be avoided whenever possible. Illustrations should not exceed 20 per cent of the text; the authors of more copiously illustrated articles may be asked to pay for the excess. The title of the paper should be as short as is consistent with clarity. Primary divisions may be indicated by central headings and subdivisions by italicized captions at the margin. Every paper should normally conclude with a summary of numbered paragraphs.

Abstracts of papers should not exceed 200 words and should not include illustrated materials except where absolutely necessary.

Figures:

All figures and tables should be numbered consecutively with legends included. Illustrations (including tables) should be planned to occupy the entire width of a page (4½ inches), and any portion of the height (7 inches). It is best to combine illustrations into the smallest possible number of groups. Original photographs should be submitted in the form of clear black and white prints on glossy paper. Care should be taken to see that they cannot be bent or folded in handling, and paper clips should not be used.

References:

References to literature should be cited by the author's name or by the literature cited reference number. The bibliography should be arranged alphabetically by author under the heading Literature Cited. Complete reference is necessary and the arrangement should normally be as follows: Harper, R. M. Some Menaces of the Study of Geology. Jour. of Ala. Academy of Science. 27:15-20. 1955.

Proofs and Reprints:

Galley proofs will be sent to the author, and the corrected proof and reprint order should be returned to the Editor. Page proofs will be sent only when necessary. Cost of reprints will be indicated at the time proofs are mailed. All manuscripts should be handed to the various Section Chairmen at the close of the Annual Academy meeting or mailed directly to the Editor of the Journal. All correspondence concerning the publication of papers, etc., within the Journal should be addressed to the Editor. Correspondence relative to securing copies of the Journal, should be addressed to the Archivist.

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The Journal of the Alabama Academy of Science is published four times a year and is sent without charge to all members of the Academy. This volume, 31, has two extra issues, July, Number 5, and October, Number 6, to bring the publication year into conformity with the Academy's new fiscal year.

CONTENTS

ABSTRACTS

Section I. Biological Sciences

Biochemical Changes in Autoclaved Peanuts Caused by Four Additional Species of Storage Fungi

Urban L. Diener and Norman D. Davis
Auburn University

Previous investigations have demonstrated that about 10 species of fungi occur frequently and abundantly in stored peanuts. The frequency and relative density of populations of these fungi were determined by making mold counts after sampling a large number of bins of farmers' stock (unshelled) peanuts, which had been stored from 1 to 5 years. Present studies were directed toward determining the biochemical changes in the peanut and its components that result from growing pure cultures of these fungi on autoclaved peanut kernels. Results with six species have been previously reported.

A uniform lot of peanuts was shelled, and 150 gm placed in each 500 ml Erlenmeyer flask stoppered with cotton. After autoclaving, hot sterile water was added to the flasks to bring the kernel moisture content to 25%. The peanuts in each flask were inoculated with a loop of spores from an established test tube culture. Cultures were then incubated at 30°C. Two flasks were withdrawn at 2-, 4-, and 8-week intervals for each of four species of fungus and for an uninoculated check. The four species were *Aspergillus candidus* Link ex Fries, *A. amstelodami* (*Eurotium amstelodami* Mangin), *Penicillium funiculosum* Thom, and *Cladosporium* sp. At the time of removal from incubation, samples were dried and killed at 130°C for 20 minutes, ground, and stored at 20°C until they were analyzed chemically.

From weight measurements, it was found that *A. candidus* had reduced organic matter about 30%, *A. amstelodami* about 10%, and *Cladosporium* sp. and *P. funiculosum* less than 5% each.

Chemically, it was found that only *A. candidus* caused a significant decrease in total oil. This fungus and *A. amstelodami* increased free fatty acids to approximately 50%, while *Cladosporium* sp. increased FFA to about 30% and *P. funiculosum* to only 4%. All fungi reduced sucrose from 4% to about 0.6% in two weeks, but by the end of 8 weeks sucrose had returned to about 3%. High organic (carboxylic) acid production was noted for *A. candidus* and *A. amstelodami*. Other data showed that all fungi decreased reducing sugars by about 50%. *A. amstelodami* and *A. candidus* increased tocopherols. *A. amstelodami* and *P. funiculosum* increased oleic acid and de-

creased linoleic. Increase in free fatty acids was primarily as oleic acid. This is an indicator of the development of hydrolytic rancidity. These results follow the general pattern obtained with six other species of fungi in the previous study. However, in this investigation *A. amstelodami* increased peroxides and carbonyls, which are a measure of oxidative rancidity. Thus, the biochemical activity of this fungus varied distinctly from that of the other nine species. Further investigation, comparing *A. amstelodami* with the other species of the *A. glaucus* group described previously to confirm this basic difference, would seem advisable.

Section II: Chemistry

Effect of 6-Diazo-5-Oxo-L-Norleucine upon Purine Biosynthesis in a Human Epidermoid Carcinoma

Paula B. Wedeles, William A. Short, George G. Kelley, and Arthur J. Tomisek
Southern Research Institute, Birmingham

Diazo-oxo-norleucine (DON) is clinically useful against some forms of cancer, but thus far its mechanism of growth-inhibition on human cell does not seem to have been reported. Of the several metabolic reactions inhibited by DON, the amidination of alpha-N-formylglycinamide ribotide (FGARP) by glutamine is about the most pertinent. This has been shown by the intracellular accumulation of FGARP in algae and mouse cells inhibited by DON.

Previous work from this laboratory has shown that drastic inhibition of purine biosynthesis accompanied by large accumulation of FGARP is caused in *E. coli* by levels of DON sufficient to cause only a small inhibition of growth. The inhibition of the purine synthesis pathway at the amidination of FGARP step was thus shown to be a primary *cause* of the growth inhibition. In the present study, the experimental procedure and the logic of these *E. coli* studies is applied to the DON inhibition of Human Epidermoid Carcinoma No. 2 (H.Ep.-2) cells grown in vitro.

Essentially, the soluble, intracellular metabolites of H.Ep.-2 cells were extracted following the short-term assimilation of sodium formate-C^{14}, separated by two dimensional paper chromatography, and detected by autoradiography on x-ray film.

Complete growth inhibition of H.Ep.-2 cells was obtained at a DON concentration of 5 micrograms/ml. This same DON concentra-

tion was also shown to cause the maximum inhibition of purine synthesis. We conclude that the primary inhibitory effect of DON on H.Ep.-2 cells is probably the same as that observed for *E. coli* cells.

Plastic Packaging Films for Irradiated Foods—Effect of Model Foods on Functional Properties of Films

R. E. Burks, Jr., and B. C. Moses
Southern Research Institute, Birmingham

The technique of preserving foods by exposing them to ionizing radiation has introduced questions about the stabilities and interactions of foods and containers after irradiation. This research was undertaken to study the compatibility of several common plastic packaging materials with some representative food components. The types of films that were used in the study were polyethylene (low and high density), Saran, poly (vinyl-chloride-acetate), poly (chlorotrifluoroethylene), and rubber hydrochloride. The following laminates were also studied: polyethylene-polyester, polyethylene-cellophane, polyethylene-aluminum-polyester-polyethylene, and polyethylene-Saran. Cottonseed oil, cottonseed oil-vinegar emulsion, and solutions of sodium chloride, lactic acid, acetic acid, methionine, and sucrose were chosen as model foods to be studied. Solutions of acetic acid, sucrose, and sodium chloride proved to be easy to package, while cottonseed oil and lactic acid were very difficult. The following evaluation tests were selected to reveal the major changes in the functional properties of the films: moisture vapor transmission rate, tensile strength, peel-seal strength, per cent elongation, and burst strength. The films were tested after irradiation in the presence of the model food, and after the irradiated food package had been stored under conditions leading to accelerated deterioration.

The samples were irradiated with gamma radiation at dose levels of 1, 3, and 6 megareps. Control samples, which received no irradiation, were also tested. Irradiation doses of 6 megareps caused some deterioration in the physical properties of high density polyethylene and poly(chlorotrifluoroethylene), and they produced some discoloration in rubber hydrochloride, poly(vinyl chloride-acetate), and poly(vinylidene chloride). Irradiation produced objectionable odors in all the films, but the odors were weakest in poly(chlorotrifluoroethylene) and poly(vinyl chloride-acetate). Two laminates, polyethylene-polyester and polyethylene-aluminum-polyester-polyethylene were the most successful packages for the difficult liquids.

Reaction Products of Maleic Anhydride with Phenylhydrazines

Frank J. Stevens and Edward M. Burgess
Auburn University

Reaction of maleic anhydride with phenylhydrazine or substituted phenylhydrazines yields either open chained maleyl monophenylhydrazides or cyclic derivatives, depending upon the conditions used. The maleyl monophenylhydrazides may also be converted into these cyclic derivatives. The nature of the cyclic derivatives depends upon the basicity of the two nitrogen atoms, which in turn is depending upon the groups substituted into the phenyl moiety of the hydrazide. The reactions of nitro-, chloro-, bromo-, dinitro-, dichloro-, and dibromophenylhydrazines with maleic anhydride are discussed.

Coordination Compounds of Niobium

James E. Land
Auburn University

The methods of preparation, the chemical and physical properties, and certain conclusions regarding the stability or constitution of coordination compounds of niobium are reviewed.

Carbon Dioxide Fixation in Liver Homogenates*

Paul Melius
Auburn University

Melius and Lipton (Fed. Proc. 16:221, 1957) reported on the excretion of organic acids by bicarbonate-fed rats. Some possible sources of these organic acids may be bone tissue, inhibition of acid metabolism, or increased kidney clearance.

The studies reported here were undertaken on the assumption that the acids resulted from an increased accumulation in the tissues of the animal. The organic acids were isolated by the method of H. Busch (J. Biol. Chem. 196:717, 1952). Citric acid and malic acid were estimated by the procedure of Pucher (Ind. Eng. Chem. 13:244, 1941) and glutamic acid by the method of Schales (Arch. Biochem. 11:445, 1946).

The rat livers were ground up in 0.25 M sucrose in a Potter homogenizer with a teflon pestle. The reaction mixtures consisted of 15 mls. of 20% liver preparation, 1.0 ml. of 0.015 M ATP, 1.0 ml.

* *This work was supported in part by a Grant-in-Aid from Auburn University.*

of magnesium chloride, and 2.0 to 7.0 mls. of 1.0 M bicarbonate buffer. The reaction mixtures were incubated in closed flasks after being gassed with nitrogen. The proteins were precipitated with perchloric acid, thus stopping the reaction. The organic acids were then separated by ion exchange chromatography.

Oxalacetic acid added to the reaction mixtures under these conditions gave the greatest accumulation of citrate at 25° and 3 hours. Malic acid and glutamic acid were found to accumulate under a great variety of conditions. It is of interest that in the alkalotic rat citric acid is excreted in the greatest quantity.

Section III. Geology and Anthropology

Geology and Ground-Water Resources of Marengo County, Alabama

John G. Newton, Horace Sutcliffe, Jr., and Philip E. LaMoreaux
U. S. Geological Survey

A study of ground-water resources in Marengo County was made during 1953-59 by the U. S. Geological Survey in cooperation with the Marengo County Board of Revenue and the Geological Survey of Alabama. The purpose was to relate the geology to the occurrence, quantity, quality, and availability of ground water in the county.

Marengo County is in the Coastal Plain physiographic province and is underlain by beds of chalk, marl, sand, gravel, clay, and shale ranging in age from Late Cretaceous to Recent. The Upper Cretaceous series is represented by the Coker, Gordo, and Eutaw formations, Mooreville and Demopolis chalks, Ripley formation, and Prairie Bluff chalk. The Paleocene series is represented by the Clayton, Porters Creek, and Naheola formations. The Eocene series is represented by the Nanafalia formation and Tuscahoma sand. Pleistocene and Recent deposits form terraces and flood plains along the rivers. All pre-Quaternary formations dip southwest about 40 feet per mile. The movement of water also is southwest except where geologic structure interferes.

Sand beds in the Eutaw, Ripley, and Nanafalia formations and the Tuscahoma sand are the most important sources of ground water in the county. There has been a decline in water levels in areas of large withdrawal by pumping and artesian flow. The greatest declines have occurred at Demopolis, where the Eutaw formation is extensively developed. Inadequate planning in future development of wells in this area could cause highly mineralized water from the

west to move toward the city. Water of poor chemical quality occurs also in other parts of the county, particularly in and west of Linden.

The Economic Geologist in Industry

Hugh D. Pallister
Geological Survey of Alabama

An economic geologist should be a combination of geologist, metallurgist, mining engineer, and economist.

The economic geologist uses his knowledge of chemistry, mineralogy, and geology to evaluate the minerals in an ore deposit and his mining engineering experience to determine how to mine the ore—the best method of underground transportation, the manner of elevating the ore to the surface, and a suitable method of beneficiation. He must also be able to estimate the cost of each operation.

The final problem confronting the economic geologist is the determination of the size of the minable ore deposit. He must calculate the tonnage of ore available, the total cost of milling, smelting, and financing the building of a suitable mill, as well as the returns from the finished products and the over-all profits, if any.

The Use of Step-Drawdown Tests to Predict Yields of Wells*

Thomas H. Sanford, Jr., and Lewis R. West
U. S. Geological Survey

Pumping tests are made as part of the detailed study of ground water in the Huntsville area in north-central Alabama by the U. S. Geological Survey in cooperation with the city of Huntsville and the Geological Survey of Alabama.

The Huntsville area is underlain by massive beds of limestone of Mississippian age that dip southeast at approximately 20 feet per mile, except where local structures exist. Ground water occurs in solution cavities developed along fractures and bedding planes in the limestone, and in chert gravel overlying the limestone.

Experience has shown that the constant-discharge method of well testing, when applied to wells tapping limestone aquifers in north Alabama, has sometimes resulted in erroneously optimistic conclusions in predicting the performance of a well under higher rates of discharge. The step-drawdown test, which is made by in-

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* *Publication authorized by the Director of the U.S. Geological Survey.*

creasing the rate of discharge by equal increments for equal periods of time, provides data that can be analyzed to obtain more accurate predictions of the performance under varying rates of discharge.

From the step-drawdown test the total drawdown at the end of each period is plotted against the corresponding pumping rate and a curve drawn through the points. The drawdown in the well caused by a planned rate of discharge of the same duration may be read directly from the curve. The drawdown for higher discharge rates may be approximated by projecting the curve. The proper pumping equipment and most efficient rates of pumping may be determined from these drawdowns.

Some Notes on the Maquiritare Indians of Venezuela

Paul H. Nesbitt
Research Studies Institute, Maxwell Air Force Base

The Maquiritare, a Carib tribe of southeastern Venezuela, were observed during the course of a four-months expedition to the Upper Orinoco drainage. Although the primary purpose of the expedition was the study of tropical medicine, numerous opportunities arose to study the local tribal groups.

The Maquiritare inhabit the upper reaches of the Cunucunuma River. They are organized into five villages, each having a population of some 80-120 inhabitants. Their economy is one of tropical agriculture (manioc) combined with hunting and foraging. They are some 300 miles from the closest white settlement and consequently have been little influenced, materially and socially, by modern civilization. Their environment, subsistence, house type, social customs, economic activities, and physical makeup are described.

Features of Caverns in Alabama

W. W. Varnedoe, Jr.
Redstone Arsenal

The presentation is divided into three parts—the passages, deposits, and entrances.

The passage part deals with the features of cave passages and rooms as determined by their formation.

The second part, deposits, concerns itself with the types and forms of minerals that are deposited in caves.

Finally, examples of entrance types are given.

Recent Archaeological Excavations in Alabama

David L. DeJarnette
University of Alabama

A program of archaeological investigation has been underway in the Weiss Reservoir since July, 1958. This is a River Basin salvage program which is being conducted by the Alabama Museum of Natural History with the cooperation of the Alabama Power Company. A preliminary surface survey of the basin, made prior to the excavation program, discovered, mapped, and recorded 305 sites.

Twenty-five of these sites have been tested or excavated to date. There is still need to work 10 more sites before the area is flooded on January 1, 1961.

The excavations and the laboratory study of the materials indicate that this area of the Coosa River was occupied by Indian peoples during all of the major cultural stages in Alabama. Paleo-Indian, Archaic, Woodland, Mississippian, and Historic. This covers a time span of approximately 10,000 years. One important aspect of the work is the possibility of establishing certain ties between the Tennessee Valley area of Alabama and the Northern Georgia area.

Alabama Geology — A Challenge

Douglas E. Jones
University of Alabama

The state of Alabama, containing within its boundaries rocks of four geological eras, is one of the finest geological "classrooms" anywhere in the world. Much important early work in Gulf Coastal Plain geology was conducted in this state which boasts of at least three dozen type localities in the Cretaceous and Tertiary areas alone.

In spite of the scenic beauty and economic wealth provided by these rocks, the geologist, to many, is merely a chap who wanders around the countryside chipping at rocks or looking through a strange instrument. But geology is no longer a field of study involving only a rock hammer and a Brunton compass. We are now in the era of detailed studies, many involving modern scientific equipment. The course of study pursued by students 25 years ago is not sufficient for some phases of the science we know today. As a consequence, geology departments in colleges and universities throughout the country are revising some phases of their instruction.

Such revision is going on in the Department of Geology at the University of Alabama. A desperate lack of new equipment is be-

ing remedied by the addition of new microscopes for paleontological and petrological work, a magnetic separator for a variety of mineral determinations, and other modern instructional and research equipment. Research space has been acquired off campus for laboratory facilities for graduate studies. For the first time in the history of this department, the faculty has been increased to a more realistic number. The department is now equipped and staffed to give instruction and/or conduct research in michopaleontology, sedimentary and igneous petrology, stratigraphy, sedimentation, geophysics, structural geology, field geology, and a variety of related mineral and ore fields, most of which are virgin areas of research in the state of Alabama and are a challenge to the modern geology student.

Resistivity Measurements as an Aid to Highway Geology

Robert D. Palmore
State Highway Department

Locating road-building materials and determining the soil-rock contact along proposed highway routes are among the primary problems of the highway geologist. The resistivity instrument has been applied to these problems by the Alabama Highway Department with varying amounts of success. Useful subsurface information was obtained along Interstate Projects I-59-2(14)181 and I-59-2(18)186 in northeast Etowah County, Alabama, by employing the "Barne's Layer Method" for procuring and interpreting resistivity data. Although several problems remain unanswered concerning earth resistivity, it is believed that the resistivity instrument offers a fairly effective means of gathering some types of preliminary road building information.

The Amateur Mineralogist in Alabama

E. O. Dahlen
Alabama Mineral and Lapidary Society

Interest in "pretty stones," either in a cursory or an acquisitive way, seems to be a human trait. With a small amount of proper training, people could more fully appreciate such stones, both from a practical and from an esthetic point of view.

Two groups of amateur mineralogists in different parts of the State, recognizing a need for such training, have formed mineral clubs for the primary purpose of educating themselves—through

the exchange of knowledge, ideas, and experiences—to a greater appreciation and understanding of mineralogy and the earth sciences. They also have a secondary objective of working with "outside" amateur groups that are interested in the subject by discussing and exhibiting mineral collections, by donating specimens, and by having field trips that are open to the public. Special attention is given to the interests of the junior amateurs within the organization and to others, such as high school and Boy Scout groups.

Commercialization of the mineral resources of the state is concentrated in the iron and steel industries. But coal, sand, gravel, marble, mica, and other minerals are also economic factors to consider; and the amateur mineralogist can further interest in the mineral resources in Alabama by reporting any unusual or interesting discoveries that he makes. Much correlation of effort and experience remains to be done along these lines, but a start has been made.

There is a need for earth scientists. Proper development of the interest of young people and the lay public in mineralogy will channel more students into geology courses in the various schools in the state.

History of the Oil and Gas Industry in Alabama

H. Gene White and Robert C. MacElvain

State Oil and Gas Board

Alabama's oil and gas industry is still in its infancy. The first commercial oil well in the state was discovered at Gilbertown, southwest Alabama, just 15 years ago. Since then, two small gas fields have been discovered in Marion County, northwest Alabama, and three additional oil fields in southwest Alabama, climaxed in 1955 by the discovery of the major oil pool at Citronelle in north Mobile County, Alabama.

Since its discovery, Citronelle has held the oil spotlight by adding 233 successful oil wells, and the end of the development is not yet in sight. Even when the geographic limits of the pool are finally determined, the Citronelle pool will still have the potential for a long life of producing oil. New engineering methods of stimulating production may eventually wring four or five times the amount of oil out of the ground as could be produced under natural conditions.

Alabama has been little explored for oil and gas even though a full half of the state is geologically favorable to the development of petroliferous deposits. So far as the discovery of oil and gas is concerned, the surface of Alabama has hardly been scratched, and it is

practically a foregone conclusion that the great bulk of our petroleum and natural gas is yet ahead of us. Perhaps our greatest difficulty, both here and elsewhere, lies somehow in the unnautral conditions which caused the extinction of the species which founded and built the petroleum industry. The future of oil, no less than its past, is totally dependent upon individuals armed with high hopes and a string of tools and persons willing to risk everything on nothing more certain than a hole in the ground.

Section IV. Forestry, Geography, and Conservation

The Howard College Natural Area

Herbert A. McCullough
Howard College, Birmingham

The Howard College Natural Area, established by the Board of Trustees for use of the Department of Biology, consists of approximately sixty acres of oak hickory forest immediately adjacent to the new Howard College campus in Homewood, Birmingham, Alabama. Fifteen acres of the tract have been developed to contain a nature trail to be made available to public school classes and science clubs, Boy Scout and Girl Scout groups, and any other organizations interested in nature education. All work is being done without cost to the College, and most of the labor has been donated by Howard College students. The trail, as currently available for use, consists of a circular path, approximately three-quarters of a mile in length, with labeled plants of interest to groups studying nature. Howard College feels that this nature trail will aid the teachers and sponsors of groups in their nature education programs. The trail is available free to any such groups who will contact the Department of Biology. The remaining acreage of the Natural Area will be devoted to research by staff members and advanced students and to use by field laboratory classes. Located in the area are the various trees of a typical oak hickory stand and a number of interesting familiar animals. Immediately adjacent to the Natural Area itself, beavers have been located.

Section V. Physics and Mathematics

Some More Curves Derived from Watt's Linkage

Roland M. Harper
Geological Survey of Alabama

At our 1959 meeting I described several kinds of lemniscates, most of them produced by different adjustments of Watt's linkage (which is three bars joined together with a marking point on the middle one). The present study carries the variations of Watt's linkage further, and shows some of its infinite possibilities. Some of the curves are the usual figure 8 type, but others are quite different and do not even have a node, as lemniscates do.

Zener Diode Characteristics and Applications

Earl L. Cook
Auburn University

The Zener Diode is a recent product of semi-conductor research. It exhibits many of the properties of the conventional diode but is differentiated from its predecessor in that the reverse volt-ampere characteristics are unique.

The characteristics of this device provide excellent means for voltage regulation and associated applications. Regulation, wave shaping, protection, and numerous other circuits are easily accomplished through use of this device.

A discussion of physical structure and characteristics is accompanied with a demonstration of typical applications.

Some Matrix Methods for Solutions of Characteristic Equations

Jimmy Phillips
Howard College, Birmingham

This paper, as the title indicates, introduces some matrix methods for solving characteristic equations. It not only contains matrix methods for determining the characteristic roots, but also a matrix transformation which can be used to determine any given number of the larger roots without having to solve for all the roots. This transformation was developed primarily for large matrices and can be repeated on any root to give a better approximation of that root. In this paper we are interested in only the real roots.

Temperature Effects of Photomultiplier Tubes

Dorwin L. Kilbourn
Auburn University

Work done by other investigators has shown that the pulse height output of photomultiplier tubes is temperature dependent. However, there has been disagreement as to cause. An experiment has been undertaken to try to resolve the argument. Preliminary results indicate that the pulse height is more greatly affected by changes in dynode temperature than by changes in photocathode temperatures.

A Method for Determining the Corrected Concentration of I^{132} in Body Organs as a Function of Time

Thomas I. Hicks and William H. Bancroft, Jr.
Howard College, Birmingham

A method is described for determining the difference in concentration of I^{132} between certain body organs and other parts of the body. Using this method, background is automatically eliminated. Compensation is also made automatically for the physical decay of the I^{132} (half-life equals 2.3 hrs.). The information is continuously recorded using a Texas Instruments RectiRiter over an interval of about 30 min. The error introduced using this method is much less than the inherent error of the radioactivity detectors used.

Section VIII. Social Sciences

The Alleged Destruction of the Southern Railroads in the Civil War

James F. Doster
University of Alabama

The damage done in the Civil War to the railroads of the South has been pictured by historians as practically complete. Examination of the subject does reveal physical destruction as spectacular. However, with few exceptions, the railroad companies were not destroyed by the war but went right on operating. After a few months most of the lines were back in limping operation. Much of the destruction had been repaired before the war ended. More important than organized destruction to the southern railroads were the rough wear and tear of military use, with inadequate repairs for four weary

years, and the severe financial losses from repudiation of Confederate debts and currency. Postwar difficulties arose not so much from the effects of physical damage to the railroads as from the growing competition between railroads and the destruction of the southern labor system.

Admiral Raphael Semmes and the Natural Sciences

Charles Grayson Summersell
University of Alabama

Admiral Semmes, who is best remembered as commanding officer of the celebrated commerce raider of the Confederacy, *Alabama,* was a man of many professions and wide intellectual interests. That he had considerable knowledge of several areas of science can be ascertained from study of Semme's published books. His interest in the natural sciences, especially hydrography, is shown in more conclusive detail by this paper. The presentation is based largely upon unpublished manuscripts of Admiral Semmes. The paper discusses Semmes's friendship with Matthew Fontaine Maury, "the Pathfinder of the Seas."

The Relationship between Thurstone's Primary Mental Abilities Tests and Certain Visual and Occular Anomalies Found in Fourth-Grade School Children

Eleazer C. Overton and Glen W. Herren
Optometrists, Birmingham

Within the past few years several reports have been made in the professional and scientific literature to the effect that visual and ocular performance in children has been found to relate somewhat to their scholastic achievement and manifest mental ability.

In these papers, the inference is drawn that, in the process of normal ontogenetic maturation and development, the human organism will meet the demands of a stressful environment through varying degrees of adaptation in form and function. It is further implied in these papers that certain deviations from species norms can be expected to relate to the concept of "adequate" or "inadequate" adaptations on the part of individual organisms.

It is also suggested in the literature that human intelligence and mental ability is closely related to how well "adapted" the individual organism is within his total milieu. The modern cultural demands

on individuals growing and developing in the present generation have placed a premium on scholastic and mental ability.

Since human vision is the acme of phylogeny and is the dominant action process in Home sapiens, it follows that the human organism in meeting a "stressful" or "demanding" environment (i.e. the schoolroom, or any other close-centered visual task) might demonstrate deviations in visual and ocular dynamics that would relate to the degree of "adequate" or "inadequate" adaptation made by individual organisms. Teleologically, we could classify as "adequately" adapted for scholastic work those children who demonstrate an above-average mental abilities profile; likewise we would see those children as "inadequately" adapted who demonstrated a below-average mental abilities profile.

In this paper, experimental evidence is presented which supports the above hypothesis. Thirty children in the 4th grade of an elementary school were given the Thurstone "P.M.A." or Primary Mental Abilities Test (published by Science Research Associates, Chicago, Illinois). The test battery is designed to evaluate several mental functions: (V)Verbalization, (S)Space, (R)Reasoning, (P)Perception, (N)Numbers; and part scores, (Vw)Verbalization on Words, (Vp)Verbalization on Picture, (Rw)Reasoning on Words, and (Rf)Reasoning on Figures. The P.M.A. is used by school systems throughout the U. S. as a reliable standard profile. Several weeks later, certain visual and ocular performance tests were made on all thirty children in the class. Twenty-seven children were found with "normal" Snellen (20/30 or better) acuity as found by the wall chart, and only two children in the class wore glasses. The ocular refractive status of the 27 "normal" children produced a distribution within an optical range between +1.50 diopters (hyperopia) and -1.00 dioper (myopia) with minor astigmatic variations. Children within this refractive range are considered by many professional eye men as not having serious ocular defects. A definitive analysis of this refractive distribution when compared to P.M.A. scores, however, did reveal very interesting relationships. It was found:

(a) Children with simple hyperopia (farsightedness) consistently scored below the mean in all P.M.A. Sub-tests (N-4)

(b) The mean P.M.A. sub-test scores for children who were found with a *differential* in "focal posture" (in optics) between far seeing (20') and near seeing (20") of less than 1.50 diopters scored above the population mean in every P.M.A. sub-test except (S) Space, and this only slightly below the mean. (N-15)

(c) The mean P.M.A. sub-test scores for children who were

found with a *differential* in "focal posture" (in optics) between far seeing (20') and near seeing (20") of more than 1.50 diopters scored below the population mean in every P.M.A. sub-test except (S) Space, and this only slightly above the mean. (N-15)

(d) Children who were found to have "focal posture" (in optics) for far seeing at emmetropia (focus for infinity) scored above the population mean in every P.M.A. sub-test except (R) Reasoning, and (Rw) Reasoning with Words. It is significant that (S) Space, (P) Perception, and (N) Number were far above the mean. (N-8)

(e) The P.M.A. Sub-tests (R) Reasoning, (Rw) Reasoning with Words, and (Rf) Reasoning with Figures, show above the mean in only the children who demonstrate some degree of myopia (nearsightedness) (N-B), myopic astigmatism, or mixed anisometropia (one eye hyperopic and the other myopic). (N-5)

(f) Children with poor spatial orientation and coordination demonstrated P.M.A. scores far below the mean in every category. (N-10)

(g) Children with manifest vertical phorias (N-10) at near point of seeing (16") scored far below the mean in every P.M.A. category with (Vp), (R), (Rw), (Rf) excessively low.

Several characteristic sex differences were found, with boys in general scoring higher than girls on (V), (Vw), and (Vp), and lower than girls in (R), (Rw), or (Rf).

CONCLUSIONS

In this experimental sample the ages range from eight years and nine months to ten years and eight months. No visual care had been given to any except the two children who were wearing glasses. Since visual defects usually have their emergence in developing children between eight and twelve years of age, it follows that this experimental sample would likely demonstrate the primary adaptations precursory to these defects. Likewise, using definitive analysis, the degree of "adequacy' of the adaptations made by individual children could be determined by comparing their visual deviations with their manifest mental ability.

From the results of this study, we might tentatively assume that if hyperopia (far-sightedness) is a more inate human visual characteristic, then it follows that the emergence of other visual and ocular deviations are results of adaptation on the part of individual organisms. The emerging visual and ocular deviations become derivatives of the organizm striving to integrate a visual input pattern with total body action patterns. Some adaptations are adequate and higher efficiency is gained; some adaptations are inadequate and the or-

ganism is deprived of efficiency.

From this, we might conclude that the degree of congruency of these patterns (visual and body total) can, to a great extent, serve as a guide to mental performance by indicating whether or not this performance is operating close to potential in any given organism.

It has been said that the human mind is the only great unexplored continent left in this world. If the above concept holds, then clinical means are now at hand, and more can be devised, to help further develop a strategic area in human performance—that of mental efficiency.

Compensation for Occupational Diseases Among Alabama Mine Workers

H. Ellsworth Steele
Auburn University

Workers exposed over the years to air carrying minute particles of certain types of dust may develop a lung disease called pneumonoconiosis. In 1951 the Alabama workmen's compensation law was amended to cover this disease which is most often found among the coal and ore miners of the state.

Alabama was led to pass the amendment by employers who feared common law awards in a mounting number of cases being filed and by big unions which sought improved working conditions and more certain, if limited, compensation for men suffering from the disease.

A study of 885 cases of men with pneumonoconiosis and interviews with company and union officials, doctors, lawyers and judges reveals much of the impact of the law. Men who have contracted the disease are now ordinarily certain of some compensation. In most cases it is paid in a lump sum, although this method of payment has many drawbacks.

Once workers have filed a claim for compensation for pneumonoconiosis they will no longer be employed by the established coal and ore companies of the state. Even men who have not filed claims but whose X-rays reveal dust on their lungs cannot secure positions with new firms and probably will not be rehired by their current employers should they ever be laid off. The number of men thus forced into unemployment or to seek other types of work (usually at much lower rates of pay) is unknown.

Under existing circumstances the unions oppose general periodic X-rays which might do much to protect workers. On the other

hand, the companies decline to employ or, ordinarily, to rehire men with the beginning stages of the disease, even though they are not physically disabled. The unions fear men will be forced out of work; the companies fear growing and, to them, unfounded claims. The common law suits and operation of the occupational disease amendment appear to have led to improved conditions in the mines which will reduce the incidence of the disease in the future. Until that day, however, the companies and many workers must pay the price of failure to work out a way to employ, yet protect, men who have early stages of the disease but who are still able to and need to work in the mines.

A Partial Evaluation of the Economic Effects of Alabama's Vocational Rehabilitation Program

J. H. Allen
Florence State College/Auburn University

The purpose of this study was to evaluate partially the economic effects of the federal-state vocational rehabilitation program. More specifically, the study attempted (1) to determine the effect the program has had upon the quality and quantity of the available supply of manpower, (2) to show the resulting effect upon the amount of incomes earned and taxes paid, (3) to show the effect of the program on the amounts involved in various types of public transfer payments, and (4) to determine the cost of the program.

Most of the data used in this study were obtained from the permanent records of a random sample of 221 recipients of vocational rehabilitation whose rehabilitation was completed during the fiscal year which ended June 30, 1959. These data were supplemented from records of the Division of Vocational Rehabilitation, State Department of Education.

Vocational rehabilitation is defined as a program established to assist disabled persons in securing adequate services in order that they will be economic and social assets to their communities.

Alabama has at present an estimated 19,500 disabled adults. In addition, approximately 4,500 persons in the state become disabled each year due to accidents, illness, or congenital causes.

During the past ten years the Alabama program has successfully rehabilitated and made available to the work force 19,100 persons.

The provision of vocational rehabilitation services costs an estimated $320.92 per person rehabilitated during fiscal 1958-1959. The

cost of administering the program during the same period was \$232.83 per person. The estimated total cost of rehabilitation per person during the fiscal year ending June 30, 1959, was \$553.75. For each dollar expended on rehabilitation during fiscal 1958-59 an estimated \$2.44 will be added to the earned income of the state each year thereafter.

As a result of the added incomes, the federal, state, and local governments receive increased tax payments resulting from the operation of the program. It is estimated that the various levels of government combined will receive \$359.02 in increased tax payments annually from each person rehabilitated.

Savings in public transfer payments which were being made to the disabled and their families prior to their rehabilitation is another positive economic factor. The payments being made to the cases included in this study were reduced by more than 65 per cent. Ultimately, the savings in public transfer payments will exceed the entire cost of rehabilitation.

While the program is basically social and can be justified as socially desirable independently from the economic aspects, it has been found that the program can also be justified from an economic standpoint. In fact, the program is essentially self-sustaining.

Your Marriage Can Succeed

Nathaniel F. Forsyth
Athens College, Athens

This paper reviews the findings and viewpoints of current books dealing with preparation for marriage. The idea is stressed that modern studies of all phases of family life can provide the beginner with guidance to his own adjustments.

Some Conceptual and Empirical Observations of Farm-Household Interrelationships

Charles L. Maddox and E. D. Chastain, Jr.
Auburn University

The farm firm and the household firm of family farm businesses are so closely entwined that the two aspects must be considered as a unit for many decisions of economic resource allocation. The schematic diagram advanced portrays conceptual guides as to optimum resource allocation between the two firms. Field observations in

Alabama substantiate the logic inherent in many of the facets of the model portrayed. The results of such observations suggest adjustments in research, educational, and managerial activities of the agricultural industry.

Some European Angles of the Juvenile Delinquency Problem

D. L. Rosenau, Jr.
Athens College, Athens

This report covers several countries on the incidence of delinquency, the social backgrounds of delinquency, and the treatment of delinquency (including preventive measures). Comparisons with the United States are implicit throughout. The information is derived primarily from the writer's experience as a judge handling delinquency cases in an Alabama county and his participation in sessions of the International Congress of Juvenile Court Judges.

Section IX. Medical Sciences

The Colorimetric Determination of Sulfhydryl Groups Using N-Ethyl Maleimide*

Barbara P. McClung and Robert W. Longley
University of Alabama Medical Center

In 1949 and 1950, N-ethyl maleimide (NEM) was used by Marrian and by Isherwood as an agent for the protection of the reduced sulfhydryl group. In 1956, Benesch, *et al,* showed that when the product of the reaction between NEM and thiol was made alkaline, a red color develops. They noted the extreme sensitivity of the test and applied it qualitatively with good success to the detection of -SH groups on paper chromatograms. They also noted that the color formed was more stable than that given by nitroprusside and that the color was not obtained with disulfide of thioethers. If such a qualitative reaction could be adapted on a quantitative basis utilizing test tube amounts there would be the obvious advantage of having a good, sensitive, colorimetric determination of -SH groups which could be read in the visible spectral range and thus easily applicable to any common laboratory colorimeter.

With this end in mind, the characteristics of the reaction of NEM with thiols was investigated. It was found that the reaction is

* *This project supported in part by USPH RG6526.*

adaptable to a quantitative basis and that the color formed follows Beer's Law. The intensity of the color formation appears to be contingent upon the water content of the reaction mixture. The stability of the color was further found to be due to the relative concentrations of the NEM and sodium ethoxide which has been used as the alkaline reagent used to bring out the color. Some attempts have been made to apply this reaction to biological systems for the assay of sulfhydryl-containing compounds.

The Effect of Thyroxine on Carbon and Nitrogen Balances during Proline Metabolism by Kidney Slices

R. W. Hanson, R. H. Lindsay, and S. B. Barker
University of Alabama Medical Center

When kidney slices from thyroidectomized rats were incubated in Ringer-proline there was an accumulation of glucose, glutamate and ammonia. A proline nitrogen balance was based on ammonia and glutamate recoveries while the carbon was based on glucose, glutamate and CO_2. Addition of thyroxine augmented the quantities of all metabolites found except glutamate. This was particularly evident if part of the incubation took place at 5°C in contrast to 37° continuously.

After a 37° incubation, as much as 85% of the proline nitrogen was recovered as ammonia plus glutamate. The ammonia accounted for approximately 70% of the proline utilized. In experiments involving initial exposure to 5° followed by 37°, nitrogen recoveries in the thyroxine vessels were again approximately 85% while controls were 103%. Thyroxine more than doubled proline utilization but glutamate levels were the same as the controls. Ammonia production accounted for the remaining nitrogen.

Following incubation at 37°, carbon recoveries fro muniversally C^{14} labelled proline were about 82%, primarily as CO_2. Smaller amounts were found as glucose and glutamate. With a preliminary period at 5° followed by 37°, the greater utilization of proline caused by thyroxine still resulted in approximately the same proportion of CO_2 and glucose as in the controls.

Effect of Ammonia and pH on Thyroxine Maintenance of Kidney Metabolism in Vitro

R. H. Lindsay, R. W. Hanson, and S. B. Barker
University of Alabama Medical Center

Long-term incubation experiments with rat kidney slices in a

proline medium resulted in an accumulation of glutamate, ammonia, and glucose with a rise in pH. Oxygen consumption was well maintained in this medium with the presence of thyroxine producing better maintenance and higher concentrations of the accumulating compounds. With glutamate as the substrate, oxygen uptake fell rapidly after 3 hours at 37°C, although better maintenance occurred with thyroxine. Glucose concentrations were considerably lower than with proline. Ammonia production was comparable in the two media for nine hours, but was lower with glutamate after 12 hours. An increase in pH occurred in both media, rapidly rising with glutamate from the initial 7.5 to 8.3 in 3 hours and continuing more slowly to 8.7 after 12 hours. With proline it increased only to 7.8 after 6 hours and reached 8.0 after 12 hours. In the proline medium an initial pH as high as 8.5 had no effect on oxygen consumption. The addition of ammonia initially in quantities comparable to those formed during incubation produced only a slight depression of oxygen uptake, glucose accumulation, and additional ammonia production. A combination of a high initial pH and ammonia level resulted in a marked drop in oxygen consumption as well as lower glucose and ammonia production. This suggests that the high pH and ammonia levels reached in the glutamate medium may be partially responsible for the poor results obtained with this substrate.

Purification and Further Characterization of the TPN-Specific 17-Beta-Hydroxy (Testosterone) Dehydrogenase*

Gerald L. Endahl and Charles D. Kochakian
University of Alabama Medical Center

Guinea pig liver has been previously reported to contain a TPN specific 17-beta-hydroxy (testosterone) dehydrogenase which can be separated from a DPN-specific dehydrogenase by centrifugation at 24,500 xg and remains in the soluble fraction even after centrifugation at 105,400 xg for 3 hours. This enzyme now has been purified by ammonium sulfate (45-55%) precipitation, paper electrophoresis, and chromatography on a column of diethyliaminocellulose. Electrophoresis indicated that the enzyme has a positive charge. The enzyme dehydrogenated only the 17-beta-hydroxyl of C-19 steroids. It showed no activity toward the 3 alpha and beta hydroxy groups of several steroids. Michaelis-Menten constants were: Testosterone 5.6 x 10^{-5}; etiocholan-17-beta-ol, 3-one, 2.07 x 10^{-5} and androstan-17-beta--ol, 3-one, 1.08 x 10^{-5}. The purified preparation did not contain the

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TPN specific enzymes: glucose-6-phosphate dehydrogenase, isocitric dehydrogenase, and malic enzyme. Transhydrogenase activity also was absent. Trivalent Al and divalent Mn, Ca, Mg, and Zn at 1×10^{-6} to 1×10^{-3}M had no influence on the activity of the enzyme.

The in Vitro Inhibition of Reduced Diphosphopyridine Nucleotide Oxidase of Guinea Pig Liver

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The rate of oxidation of reduced diphosphopyridine nucleotide (DPNH) by guinea pig liver homogenate as measured spectrophotometrically at 340 millimicrons was inhibited as much as 85% by the presence of micromolar amounts of steroids in water solution. The relative inhibitory powers of these steroids on DPNH oxidase in descending order are: epiandrosterone, 11-desoxycorticosterone, androstan-17 beta-ol, 3-one, progesterone, androstanedione, androsterone, beta-estradiol, testosterone, 4-androstenedione, estrone, etiocholan-17 beta-ol, 3-one, etiocholanedione, 11-dehydro-17-hydroxypregnenolone. The micromolar concentration necessary for 50% inhibition ranged from 7 to 130. Concentrations of steroid as low as 5 micromoles produced significant decreases in the rate of DPNH oxidation, while concentrations as high as 100 micromoles did not completely inhibit it.

Under similar experimental conditions DPNH oxidase activity was inhibited completely by 5×10^{-5}M p-chloromercuribenzoate, 10^{-4}M NaCN, and $AgNO_3$; 85% by 5×10^{-3}M sodium amytal, 5×10^{-4}M $CuCl_2$; 50% by 10^{-2} M NaN_3; 10% by 10^{-4} M KNO_3 and $HgNO_3$; 5% by 10^{-3} M $FeCl_3$ and was stimulated 20% by 10^{-3}M versene.

A sharp pH optimum for DPNH oxidase using a phosphate buffer system was determined to be between 8.0 and 8.2. This pH optimum was not altered by the presence of steroid inhibitors.

Effect of Testosterone on the Metabolism and Incorporation of Glycine-2-C^{14} in Guinea Pig Tissues

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The increase in body weight produced by androgens is due in great part to the increase in muscle mass. This expression of the protein anabolic action of the androgens is best seen in the guinea pig. (Endocrinology 60:607, 1957). In order to obtain further in-

sight into the nature of this growth and its variation among the different muscles, the in vivo incorporation of glycine-2-C^{14} into the various muscles and organs of the guinea pig was studied.

Castration and testosterone propionate did not affect the ability of the liver, kidney, stomach, ileum, or heart to incorporate glycine-2-C^{14} into their proteins. The rate of incorporation in the seminal vesicles and prostates, however, was decreased by castration and increased to above normal by the androgen. The rate of incorporation of glycine-2-C^{14} into the protein of the 48 different muscles was not affected by castration except for the diaphragm which was slightly decreased. Testosterone propionate, on the other hand, greatly increased the rate of incorporation of radioactive material into the protein of the retractor penis and temporal muscles and restored that of the diaphragm to normal. Small increases were produced in several other muscles.

Castration and testosterone propionate did not alter the amino acid composition of the tissues. All of the tissues contained radioactively labelled serine, as well as glycine, and the internal organs also contained small amounts of radioactively labelled aspartic and glutamic acids. The serine: glycine ratio was approximately 1:1 for liver, 1:2 for kidney, seminal vesicles and prostates, and 1:3 for the muscles.

The changes in radioactivity in the protein of the various tissues were reflected by comparable changes in the radioactivity of both the glycine and serine, except the incorporation of serine in the seminal vesicles was not influenced by castration or testosterone propionate. The changes were due to the incorporation of glycine.

Bovine Submaxillary and Sublingual Mucins

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Mucins have been isolated by mild procedures from aqueous extracts of bovine submaxillary and sublingual glands. The sublingual mucin was obtained by successive precipitations at 2-5° with ammonium sulfate (at 10 to 20% saturation), sodium sulfate (2.3 to 6.5%), and calcium chloride in 60% ethanol. The submaxillary mucin was obtained by electro-deposition and subsequent ammonium sulfate fractionation. Physical methods indicated that no appreciable degradation occurred during the preparations. The products dissolved to give clear, viscous solutions.

Bovine submaxillary mucin contained about one-third peptides,

and the remainder was composed of equimolar ratios of sialic acid and galactosamine. Bovine sublingual mucin generally had a composition much like known blood group substances. The best product, probably still not pure, contained less than 20% of protein. The carbohydrate portion was comprised of the following molar ratios of sugar units: D-galactose (2), hexosamine (galactosamine and glucosamine) (2), sialic acid (1), and *L*-fucose (1).

By digestion with trypsin at 37°, both mucins rapidly lost their viscous nature, but no hexosamine or sialic acid appeared in dialyzates.

The Stability of Hyaluronic Acid under Various Conditions

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Hyaluronic acid is very sensitive to temperature and is spontaneously degraded even at 4°, although at a very slow rate. Such degradations can be prevented completely if it is stored at -10° or with high concentrations of alcohol incorporated in its water solutions. Slight decrease will occur in the presence of alcohol if the solution is made in 0.2M phosphate buffer.

The Rate of Proliferation of Embryonic Ganglion Cells in the Chick

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In order to determine whether the duration and rate of proliferation of sensory ganglion cells would be modified by disturbance of normal embryonic relationships, head process and early fold blastoderms were subdivided into fragments. These were grafted into the coelom of 3 to 3.5 day embryos or on the chorio-allantoic membrane of 8.5 to 10 day embryos and were allowed to grow from 7 through 9 days. Ganglia and other structures developed more frequently in grafts of fragments which included the head process, anterior primitive streak, or the entire Hensen's node. The rate of proliferation within the ganglia of normal and experimental material is expressed as the percentage of dividing to non-dividing cells.

The division rates in the ganglia of grafts from different areas did not vary appreciably if the age of the graft was the same. Accordingly, the rates of proliferation were averaged and for days 7 through

9 were: 0.7% at 7 days; 0.4% at 7.5 days; 0.9% at 8 days; and 1.1% at 9 days.

By comparison, the proliferation rates in normal ganglia of spinal levels 14, 15, and 16 are as follows: 2.7% at 4 days; 2.2% at 4.5 days; 2.1% at 5 days; 1.6% at 5.5 days; 1.1% at 6 days; 0.6% at 7 days; 0.4% at 8 days; 0.4% at 9 days. A comparable decrease in the rate of proliferation occurs in spinal ganglia of other levels and in the semilunar ganglion of the fifth cranial nerve.

The results thus indicate that in ganglia or grafts where normal embryonic relationships no longer occur, the rate of proliferation does not correspond to normal but exceeds it appreciably during the 8th and 9th days.

An Investigation of the Structures Supporting the Teeth by Means of Force-Movement-Time Studies

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The tooth is held in its socket by the periodontal membrane, a fibrous structure 0.2 mm. in thickness. This structure allows a degree of movement of the tooth, the three structures constituting a movable joint. Although the normal physiological movement is so small that a sharp sound is produced on percussion, it is nevertheless discernible on palpation and on close inspection.

Histological examination shows that the periodontal membrane is traversed by bundles of fibers which pass obliquely from the root surface to the alveolar bone, at the origin and insertion of which roughening of the surface is common. The presence, direction, and attachment of these fiber bundles suggest that they support the tooth under tension. The histological prominence of these fibers might suggest that they provide the main support.

Change in the clinical mobility of teeth takes place with disease of the periodontium, but rapid physiological change in mobility can also take place, for instance during the menstrual cycle and during and immediately after pregnancy. Measurement of this movement, with known force under various conditions, was considered a possible approach to the investigation of the nature of the structures which support the tooth, their mode of action, and the nature of the changes which allow increase or decrease in tooth mobility.

A machine has been designed capable of measuring either tilting or axial tooth movement from 0-0.05 mm. with an accuracy of 0.001 mm.±10% ,which automatically records movement and force or movement and time on chart recorders.

From the study of the curves so made following measurements at various times of the night and day, after preloading, the taking of drugs, postural change, and after periods of natural or enforced rest by splinting, it would appear that the tooth is supported in its socket by more than one distinct system, and that these systems are capable of measurable change in a matter of minutes. Two appear to act like fluid systems, subject to loss and regain of fluid, one like an elastic body, and one like a check.

Microradiography of Bone and Teeth

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Undecalcified sections of bone and tooth have been studied with light and low kilovoltage microradiography. Various degrees of calcification have been observed in different concentric lamellae of the same haversian system, coinciding in some instances with the intrahaversian cement line of light microscopy. Attempts have been made to increase contrast in the microradiographs by immersing the sections in solutions of heavy metals. With lead acetate the concentric nature of the lamellae is emphasized, and certain areas become more radiopaque than others. In the tooth sections, the dentin matrix immediately surrounding the dentinal tubule was found to be hypercalcified as compared with the rest of the dentin. This is confirmed by electron microscopy. Enamel, because of its high mineral content, revealed little structure unless it had been previously partially decalcified either by caries or by acids in vitro. However, certain pathologic and developmental deficiencies can be studied with microradiography.

Experimentally Produced Hardness Changes in Dentin

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Newly erupted, non-carious teeth have been used in this study. Cavities were prepared with high speed dental engine using the conventional technique. The cavities were filled with (1) amalgam only or (2) calcium hydroxide as a base and amalgam. Whenever possible a tooth to be extracted was left unoperated in the same mouth.

The fillings were *in situ* for varying lengths of time, and after extraction they were embedded in plastic and bisected longitudinally

through the mid-point of the filling. Hardness tests were done on the longitudinal sections. Transverse sections were then cut and hardness tests done at various levels between the base of the filling and pulp.

A significant increase in hardness was found in the calcium hydroxide covered dentin as related to (1) dentin in non-operated teeth in same patient, (2) unaffected dentin in same tooth, and (3) amalgam covered dentin in same patient. No significant increase in hardness was noted under amalgam covered dentin as related to unaffected dentin.

Intradermal Skin Test in Systemic Lupus Erythematosus*

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It has recently been reported by Miescher and Strassle (Vox Sanguinis 2:283, 1957) and by Holman *et al* (Science 126:162, 1957); J. Exper. Med. 109:97, 1959) that the serum of patients with systemic lupus erythematosus contains factors which produce serological reactions with various nuclear components. Specific reactions have been found with DNA, nucleoprotein, and histone. Therefore the questions have been raised as to whether or not these factors represent circulating autoantibodies against nuclear material, and if so, what is their role in the L. E. cell phenomenon. It was felt that another interesting approach to this problem would be a study of delayed hypersensitivity by the use of intradermal injections of white blood cells. The latter were injected at concentrations of 500,000 cells per mm^3. Positive reactions have been found in 80% of SLE patients tested to date. They have been negative in patients afflicted with other diseases, including rheumatoid arthritis. These skin reactions usually develop at 10-12 hours after the injection rather than at 48-72 hours, which is classical for delayed skin reaction. The possibility of this being a non-specific reaction to tissue injury is therefore being considered. Nevertheless, it may serve as a useful diagnostic test in the connective tissue group of diseases.

Insulin Reserve as Indicated by the Tolbutamide Tolerance Test

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Vallance-Owens and others have demonstrated an increase in

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the blood "insulin" level following the administration of tolbutamide utilizing a bio-assay method for the determination of insulin. Unger and Madison have demonstrated in several hundred patients that the drop in fasting blood sugar twenty and thirty minutes following administration of 1 gram of tolbutamide intravenously forms a characteristic curve for both the diabetic and non-diabetic patient. The drop is to 84 per cent or less of the fasting value in twenty minutes and 77 per cent or less in thirty minutes. Diabetic patients respond less rapidly.

Utilizing this technique the authors have 59 tests in 51 students with the following results: Sixteen abnormal curves have been noted in this group. By Unger and Madison's criteria three have a 21% probability of diabetes, four have a 56% probability, five have a 91% probability, three have a 99% probability, and one a 100% probability. Of interest is the fact that one abnormal test reverted to normal after stopping dexedrine, and one test which was abnormal following working all night reverted to normal after a night's rest. Zero per cent of those students with abnormal curves have a family history (parents and/or siblings) of diabetes, and 12.5 per cent of those with normal curves have a family history of diabetes. Of further interest is the fact that a few students who smoked during the test had abnormal curves which on repeat without smoking reverted to normal.

Further tests are now underway regarding the effect of dexedrine and tobacco on carbohydrate tolerance and insulin reserve. Furthermore, insulin reserve is being tested in thyrotoxic patients, in hypothyroid patients, and in individuals on steroids as well as in mothers who have produced large babies.

Components of the Vagus Nerve of the Rhesus Monkey

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Normal mid-cervical, recurrent laryngeal, and esophageal nerves and degenerated nerves following various operative procedures have been impregnated with pyridine silver or stained with Sudan Black B for myelin and counted using an ocular grid estimation technic. Normal nerves have been examined with the electron microscope.

The normal mid-cervical vagus contains an average of approximately 60,000 nerve fibers of which only about 7,000 are myelinated Intracranial vagotomy did not cause a quantitatively detectable loss of fibers in the cervical vagus; however, microscopically, a small

amount of degeneration was evident. Mid-cervical vagotomy resulted in nearly a complete degeneration distal to the section in the cervical vagus and recurrent laryngeal nerves and in approximately half of the fibers in the ipsilateral and contralateral esophageal nerves distal to the pulmonary plexus. Stellate ganglionectomy caused degeneration of all but a few fibers in the cervical sympathetic trunk; however, the cervical vagus and esophageal branches were intact. Degeneration of some of the fascicles accompanying the recurrent laryngeal nerve following this procedure was evident, but many of the non-myelinated axons remained.

The nodose ganglion lies largely within the jugular foramen in the rhesus monkey and contributes nearly all of the fibers of the esophageal nerves, over 95% of the total fibers in the cervical vagus, and a detectable number to the recurrent laryngeal nerves.

Serum Viscosity Studies in Rheumatoid Arthritis*

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The average viscosity of serum from patients with rheumatoid arthritis is greater than that from normal subjects. This difference in viscosity is almost 10 per cent and increases at lower temperatures. It was shown that penicillamine incubation greatly reduced the latex titer but did not affect the viscosity. The total protein content of rheumatoid serum was less than that of normal serum. The rheumatoid sera showed inversion of A/G ratio with globulin levels sufficiently elevated to account for the increased viscosities.

Renal Excretion of Endogenous Metabolites
I. Reversal by Glycine of Inhibition of Urate Excretion

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Thirty studies have been performed on normal volunteer human subjects, twenty utilizing sodium benzoate and ten utilizing acetyl salicylic acid, to study the effect of these substances on the excretion of endogenous uric acid. A transistory inhibition of endogenous uric

* *This work has been supported by a grant from the National Institute of Arthritis and Metabolic Diseases, National Institutes of Health, Bethesda, Maryland, and the John R. Irby Fund for the study of arthritis.*

acid excretion was noted following i. v. injection of 244 mg. of sodium benzoate. This inhibition could be reversed by glycine injectine. Conversely, one gram of sodium benzoate caused increased uric acid excretion. Because of the similarity of these results to the "paradoxical' effects of varying doses of salicylate on uric acid excretion, the effect of glycine following salicylate administration was studied. A reduction of 29-45% in the rate of endogenous uric acid excretion after 0.5-1.5 gm. oral salicylate can be reversed by administration of glycine.

Electron Microscope Studies of Cellular Membranes in Glandular Tissue

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In this investigation basal infolding membranes of hamster submaxillary and parotid glands have been examined in detail. These structures originate as invaginations of the plasma membrane at the base of striated duct cells. They are not found in close association with ribonucleoprotein granules as is the endoplasmic reticulum of acinar cells, but more nearly resemble Golgi and mitochondrial membranes. Within the cell the infolded membranes are seen to branch, anastomose, and form highly complex arrangements. Occasionally, rounded vesicles are found in relation to the double membranes of this system. These apparently pinch off and contribute to the secretory process. Mitochondria are more numerous in the striated ducts than elsewhere in the glands. Here, the intimate relationship of mitochondrial and basal infolded membranes is striking. In some areas the morphology of the infoldings is suggestive of a possible method for the *de novo* formation of mitochondrial membranes.

The Gross Anatomy of the Cervical Sympathetic Trunk in the Rhesus Monkey*

Marion Garrett
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The sympathetic trunk lies along the transverse processes of the cervical vertebrae medial to the vagus nerve and closely related to it. As it passes into the thoracic region, the sympathetic trunk crosses behind the vagus nerve and becomes dorso-lateral to it.

* *Macaca mulatta.*

The superior and middle cervical ganglia and the stellate ganglia are included in this region. The superior ganglion is located at the level of the first and second cervical vertebrae. It gives branches to the internal carotid artery, the jugular ganglion, the vagus nerve, the carotid plexus, the superior laryngeal nerve, and one or more of the first three cervical nerves.

The middle ganglion, the smallest, is located just above the subclavian artery. It has no communicating rami to the cervical nerves. It gives branches to the subclavian artery, the vagus nerve, the recurrent laryngeal nerve, the deep cardiac plexus, the superficial cardiac plexus (on the left) and the phrenic nerve (on the right).

The stellate ganglion is located at the level of the first and second ribs, and is a fusion of the inferior cervical ganglion and the first and second thoracic ganglia. This ganglion gives rami to the seventh cervical through the second thoracic nerves. One branch goes to the vertebral artery, forming the vertebral plexus. A branch passes from the right stellate ganglion to the right atrium and one passes from the left stellate ganglion to the superficial cardiac plexus.

James Somerville McLester: Scientist-Physician

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Dr. James Somerville McLester was born in Tuscaloosa and his family moved to Birmingham when he was six years of age. He attended the University of Alabama where he graduated with the A.B. degree in 1896. He graduated with the M.D. degree from the University of Virginia in 1899. Following post-graduate training, he entered private practice of internal medicine in 1902 in Birmingham where he continued as an active practitioner until his death. After four years of practice, he spent a year in Berlin and Munich studying physiological chemistry. From the first, he maintained a clinical laboratory, initially doing his own laboratory work.

On the entrance of the United States into the First World War in 1917, Dr. McLester volunteered and was commissioned a Lieutenant in the Medical Reserve Corps of the Army. He was Chief of Medicine at Camp Sheridan in Montgomery and in the spring of 1918 was commanding officer with the rank of Lieutenant Colonel of Evacuation Hospital, Number 20, Camp Grant, Rockford, Illinois. The unit was brogen up on arrival in France and Dr. McLester was sent

to Brest as medical consultant. He returned home in January, 1919, with the rank of Colonel.

On returning to Birmingham in 1902, he was appointed Professor of Pathology in the Birmingham Medical College and continued on the staff until the school closed in 1915. When the Medical College of Alabama was moved to Tuscaloosa in 1920, Dr. McLester was appointed Professor of Medicine, a position he held until 1949. He was the author of about 100 papers, and his textbook, *Nutrition and Diet in Health and Disease*, went through six editions. He was awarded the Goldberg Gold Medal by the American Medical Association, and the LL.D. by the University of Alabama. He was President of the Jefferson County Medical Society, the Medical Association of the State of Alabama, and the American Medical Association. Dr. McLester married Ada Bowron in 1903. They had three children: Anna, James B., and Jane. Mrs. McLester died in December, 1945, and Dr. McLester died on February 8, 1954.

ARTICLES

Correlations in the "Coal Measures" of the Southeast

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INTRODUCTION

The coal-bearing rocks of Alabama are a continuation of the great Appalachian coal field which begins near the southern state line of New York and stretches for 800 miles southwestward. The Alabama fields constitute the most nearly isolated portions of that area and have been studied least in relation to the entire region. Attempts at wide regional correlation of some coal beds and their enclosing formations have been made by Hayes[1], Stevenson[2], and Wanless[3]. Of the three, Hayes and Wanless confined themselves to the Southern Appalachian field. Wanless made a section near the Alabama line but did not enter the state. Hayes published geological folios of several quadrangles: the Ringold, Georgia-Tennessee[4]; the Chattanooga, Tennessee[5]; the Sewanee, Tennessee[6]; the Stevenson, Alabama-Georgia-Tennessee[7]; the Gadsden, Alabama[8]; and the Rome, Alabama-Georgia[9]. He engaged in little discussion of coal bed correlations but did use a uniform formation nomenclature.

The first attempt at correlation of northeast Alabama coals with those of southern Tennessee was made by McCally[10]. Shotts[11] has recently discussed the Alabama-Georgia-Tennessee correlation problem as well as some problems of correlation within Alabama.

In this paper the pertinent parts of the work of these writers will again be briefly reviewed, along with the modern works of Nelson[12], Wilson, Jewell, and Luther[13], and Luther[14]—dealing with Tennessee alone and those of Butts[15], [16], [17]—limited to Alabama alone. Certain difficulties and inconsistencies will be pointed out and tentative suggestions for some broad correlations will be made. Past attempts at horizon correlation among Alabama's several coal bearing areas will also briefly be reviewed. The principal purpose of this paper, however, is not to present solutions but to point out problems and possible lines of study which, if pursued, might eventually lead to some systematization of our varying area-unit, lithologic-unit, and age-unit terminology.

PAST ATTEMPTS AT CORRELATIONS AMONG ALABAMA AND TENNESSEE COAL BEDS AND ENCLOSING STRATA

McCalley, in his very comprehensive report on the Plateau field, based his correlation of stratagraphic units on Colton's type section which was made at the Etna mines in southeast Marion

County, Tennessee, about two miles north of the Alabama line. In his section, Colton erroneously labelled as the Sewanee a coal bed about 45 feet above the "Etna" or "lower" conglomerate. Stevenson[2] says:

> Professor Colton identifies with the Sewanee his bed at 45 feet above the Cliff sandstone, but his identification, which has been accepted by Mr. McCalley in the Alabama reports, is not consistent with the type section, where the coal bed is above the Bon Air (Sewanee conglomerate, 13) and at varying intervals below the sandstone which is at the top of both Etna sections (possibly the Rockcastle sandstone).

All the evidence in the later literature supports this contention of Stevenson so that the bed termed the Sewanee by McCalley throughout his report is probably the Upper Cliff of Georgia and Alabama and the Wilder or Angel of Tennessee. McCallie[18], in his report on the coals of Georgia, also points out McCalley's error and suggests the name Upper Cliff for the coal in question. Wanless[3] in his modern summary terms this bed the Upper Cliff.

Stevenson[2] made the most ambitious attempt, in print, at wide regional correlations of eastern coal beds. His is the only report which embraces the entire region from Pennsylvania and Ohio to Alabama. He relies on the work of other geologists, using their sections and reports, but he sometimes takes issue with published material as in the case of McCalley[10], cited above, so that he may at least have ridden through the region.

Stevenson suggested the following relations:

1. Both the Bon Air sandstone (Sewanee conglomerate) and the Etna (Warren Point) sandstone extend from Tennessee into Alabama.

2. The Bon Air is the Upper conglomerate of McCalley[10] and the Second conglomerate of Gibson[19].

3. The Etna sandstone is the Cliff or Lower Etna sandstone of Safford in Tennessee and the Cliff sandstone or Millstone grit of McCalley in Alabama.

4. The Sewanee Coal bed extends into Alabama (on Raccoon and Lookout Mountains) but is little mined in that state.

5. The Etna coal bed is the Cliff or Main Etna of Safford in Tennessee, the Castle Rock in Georgia, and the Cliff bed of McCalley in Alabama.

6. The Bon Air sandstone does not occur on the Cumberland Plateau of Jackson County north of the Tennessee River except on Keel Mountain near Paint Rock. It can also be inferred to be

present on Gunter's Mountain in Marshall and Jackson Counties.

7. The Etna sandstone forms the main bluff on the west side of Raccoon (Sand) Mountain in Jackson County, but on the east side the Bon Air sandstone is 75 to 80 feet thick and presumably forms the more prominent cliff.

8. The bed designated Sewanee by McCalley is identified as the Cashie (Caskie) of Gibson[19] and is persistent all the way down to Blount Mountain.

9. The interval between the Bon Air and Etna sandstones varies widely but thickens enormously in Blount Mountain. Likewise, the "sub-conglomerate" measures and the Bon Air sandstone itself thicken greatly. The Bon Air sandstone of Stevenson is probably the Boyles sandstone of Butts[15]. The great thickness of "sub-conglomerate" measures noted in Blount Mountain probably includes Butts' Parkwood beds.

10. Stevenson admits that in the absence of coal beds above his Bon Air sandstone "almost everywhere south from the Etna mines in Tennessee, to Blount County, stratigraphy is helpless and the final determination must be made by paleobotany."

11. He makes no attempt to correlate the Berry Mountain section either with Blount Mountain or the type section.

12. He states: ". . . the Sewanee bed is mined to some extent for use in Gadsden . . ."—presumably from Lookout Mountain.

13. He notes: "The temptation to suggest that the 3rd and 4th conglomerates (of Gibson) are equivalent to the Rockcastle and Corbin (of Tennessee and Kentucky) is very great . . ."

Hayes probably did more extensive mapping of coal-bearing rock in Alabama than any other geologist. Although his formation names have not survived, his work has undoubtedly influenced later work, both in Alabama and Tennessee.

Hayes divided the Pennsylvania rocks into two groups. Everything from the top of the Lookout sandstone (which was usually the Sewanee conglomerate in Tennessee) to the base of the coal measures he termed the Lookout formation; and everything above, he designated as the Walden formation. Comparison of Hayes' maps of the Sewanee[6] and Chattanooga[5] quadrangles with the modern mapping of Wilson, Jewell, and Luther[13] make it certain that Hayes included the Rockcastle conglomerate in his Walden unit. It is not clear, however, from his summary report[1] where the top of the Walden was placed. His suggestion[1] that the Jellico and Sewanee beds are equivalent is certainly erroneous, although his apparent correlation of the Walden formation with the Lee forma-

tion of the Jellico district is consistent with that of later writers[20]. His map seems to make the Walden formation equivalent to everything above the Lookout sandstone.

From Hayes we may conclude:

1. The Lookout sandstone is the equivalent of the Sewanee conglomerate of Nelson[12] and of Wilson, Jewell, and Luther[13].

2. Hayes' sections in the Chattanooga and Sewanee quadrangles and his mapping around the Aetna (Etna) mines, as compared to that of Wilson, Jewell, and Luther, suggests that he probably mapped the base of his Walden formation in some areas on a sandstone with lies *below* the Sewanee—probably the Etna of Stevenson or the modern Warren Point. He shows[5] the Etna and Nelson coals to be above the Lookout conglomerate, whereas they actually are below both the Sewanee and Warren Point sandstones. He places the Sewanee conglomerate correctly at Whitwall[6] but has it too low (as in Colton's section) at the Etna locality[5].

Figure 1 shows the Lookout and Walden sandstones as mapped by Hayes in the Chattanooga, Sewanee, Stevenson, Ringold, and Gadsden quadrangles. This figure will be referred to again when the work of Butts is discussed.

Wanless[3] gives an excellent review of the stratigraphic terminology and confirms a number of conclusions mentioned above. Among them are:

1. The Sewanee is the Second and Upper conglomerate respectively, of Gibson and McCalley.

2. McCalley's Lower and Gibson's First conglomerate are the Warren Point sandstone of Nelson[12].

3. The Battle Creek bed is the Castle Rock bed of Georgia, the Etna bed of Tennessee, and the Cliff bed of Alabama and Georgia.

Wanless used Nelson's[12] nomenclature for southern Tennessee, but recently the Tennessee Division of Geology of the Department of Conservation has published a revised system. This revised system is shown in the Tennessee section of Figure 2. It can be seen that the Gizzard group of the new Tennessee system is not quite the same as Hayes' Lookout formation because its upper limit is the bottom, not the top, of the Sewanee conglomerate. The Crab Orchard Mountains group is, except for the Sewanee conglomerate, again roughly the same as Hayes' Walden formation; and its upper limit may be about the same as that of the Lee group, as used by Nelson[12] and Glenn[20].

The remaining important work which must be fitted into the

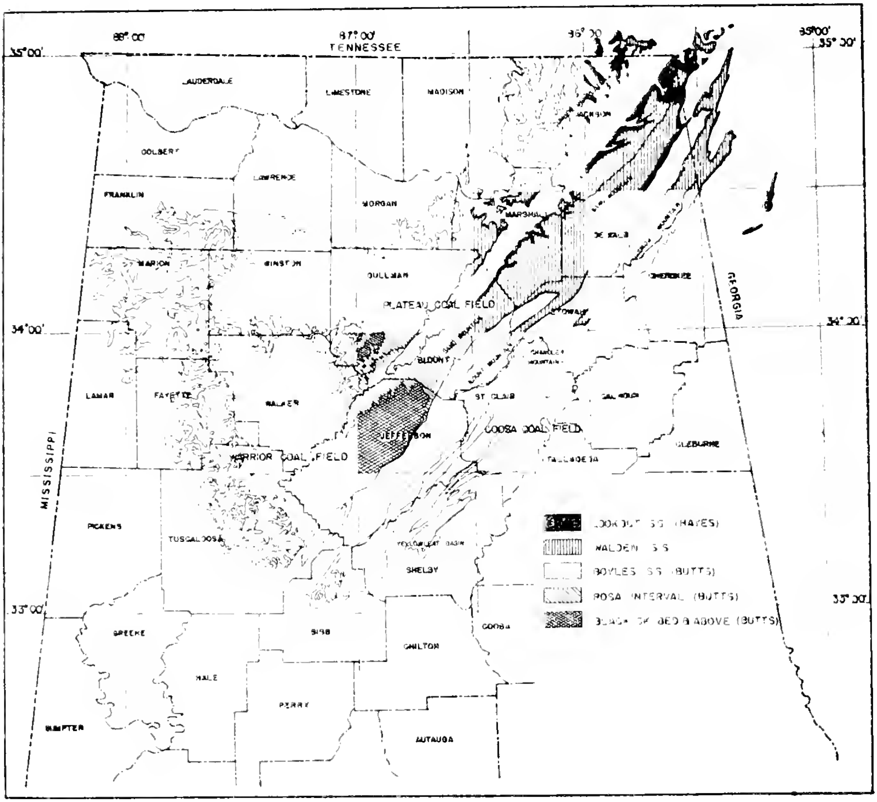

FIG. 1—Map showing the areal distribution of Hayes' Lookout and Walden formations in northeast Alabama and of the three units of Butts in the Birmingham quadrangle.

northeast Alabama picture is the Birmingham quadrangle folio of Butts[15]. Butts perhaps had a wider acquaintance with all the Alabama coal fields than any other writer, although McCalley may have been more familiar with the Warrior field and Hayes and McCalley with the Plateau field.

Butts' general section of the Birmingham quadrangle is shown in Figure 2. The most unexpected difference in stratigraphy between the Birmingham area and those mapped by Hayes apparently is (a) the presence of only one thick basal sandstone and (b) the presence and thickness of the Parkwood wedge on the east side of Blount Mountain and its thinness or absence on the west side. As suggested above, Hayes, McCalley, and Gibson apparently included the Parkwood in their sub-conglomerate measures. Butts

correlates the Boyles sandstone with either the Pine sandstones alone or the combined Pine and Shades sandstones of the Cahaba and Coosa coal fields. He favors the former correlation:

> . . . in view of the unconformity at the base of the coal measures of the Warior coal field, it is highly probable that the basal beds of the Cahaba field are older than those of the Warrior field and that the Shades sandstone and the overlying shale of the former are not represented in the latter.

This is in conformity with the southeastward-northwestward thickness changes in the area which were observed by Hayes, McCalley, and possibly Gibson and with the simplified depositional picture of the area presented by King[21].

Regarding correlation with Hayes' nomenclature, Butts says:

> This heavy sandstone (Boyles) has been correlated with the conglomerate at the top of the Lookout but on paleontologic evidence David White concludes that the top of the Lookout lies near the horizon of the Mary Lee coal . . . and that the beds below that coal, including the Boyles sandstone, corespond to the Lookout formation.

Butts later states that White says the horizon of the Soddy coal of Tennessee, a coal which Hayes places below the Etna sandstone at the Etna mines near Chattanooga, is equivalent to the Mary Lee or Newcastle bed. In the Bessemer-Vandiver folio[16] he repeats this correlation, but in another work[17] the Sewanee bed is tentatively correlated with the Newcastle of Alabama and the Cliff with the Ream. The latter correlation places the Soddy—which is between the Sewanee and Cliff in Tennessee—opposite the Jagger, Blue Creek or Mary Lee—which lie in the corresponding interval in Alabama. The "Soddy" bed is hard to identify because Luther[14] lists Soddy Nos. 7, 9 and 12 which are correlated with the Richland, Sewanee, and Oakdale beds, respectively. In spite of the indeterminancy of identification of the "Soddy coal" it seems likely that Butts meant generally to correlate* the *Sewanee group* of beds with the *Mary Lee* group or at least with the upper beds of that group.

SOME PROPOSED GENERAL CORRELATIONS OF CERTAIN ALABAMA UNITS WITH THOSE NOW STANDARD FOR TENNESSEE

When the author read an earlier paper[11] before this body that contained some suggestions for the correlation of Alabama and Tennessee lithologic units, Nelson's southern Tennessee work[12],

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* *Following White, although he nowhere gives a reference to any work of White's which specifically states the correlation. Perhaps it was in a personal note from White or was inferred from some work of White's listing characteristic fossils at different horizons.*

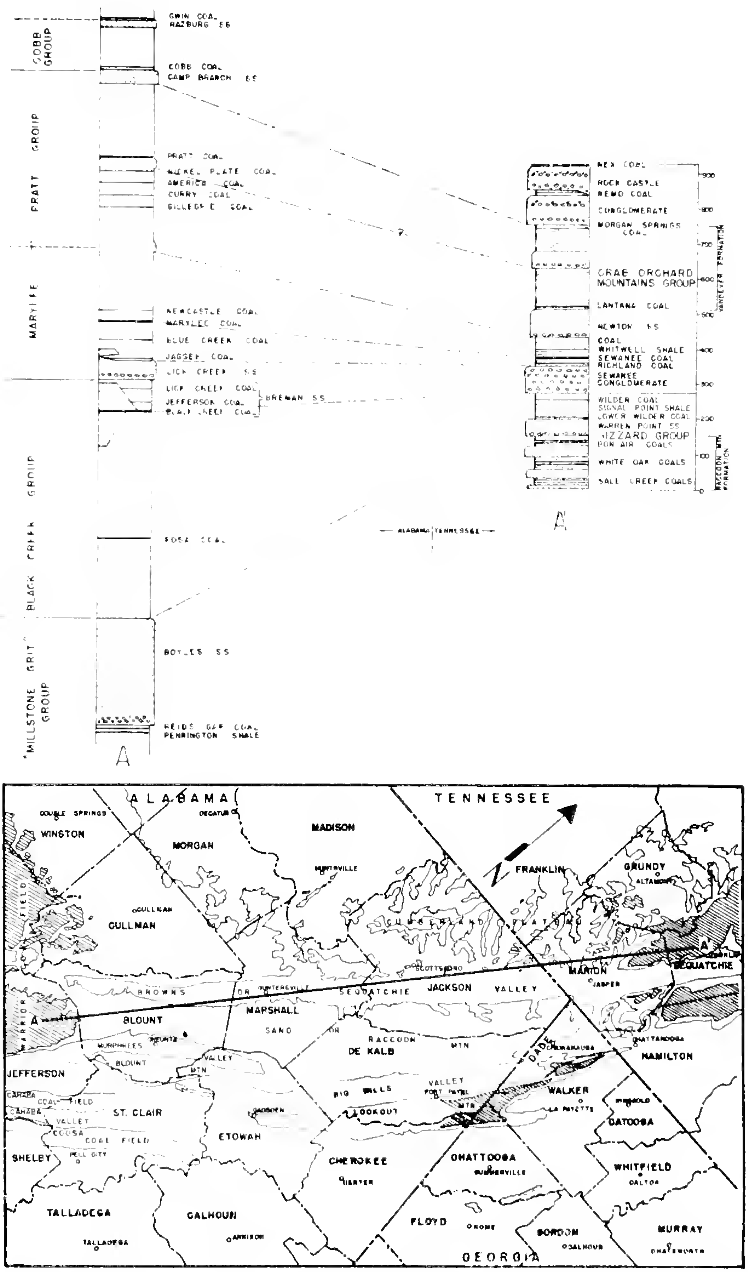

FIG. 2—Diagram showing some possible correlations of Tennessee and Alabama stratigraphic units along a northeast-southwest line. The map shows the line of section and the areas underlain by the Black Creek coal bed in Alabama and the Sewanee coal bed in Tennessee and Georgia.

possibly with some modifications due to Wanless, was taken as a sort of "standard" and the Alabama units were fitted to the Tennessee terms and sections. Since that time, the Division of Geology of the Tennessee State Department of Conservation and Commerce has published its new nomenclature system[13] with coal bed and sandstone correlations worked out to an extraordinarily complete degree. Because of this very excellent new "standard" of stratigraphy now available north of the Alabama line, the writer welcomed the opportunity to re-examine the subject when the program chairman suggested the general topic of correlations and other problems remaining in Alabama Pennsylvanian geology.

Figure 1 shows the areal distribution of Hayes' Lookout and Walden formations in the Gadsden, Stevenson, Ringold, Chattanooga, and Sewanee quadrangles and of three mapped units of Butts[15] in the Birmingham quadrangle. The units in the Birmingham quadrangle are (a) the Boyles sandstone, (b) the interval between the Boyles sandstone and the Black Creek coal bed, and (c) the rocks above the Black Creek coal bed. Fortunately, the Birmingham, Gadsden, Stevenson, and Chattanooga quadrangles form an almost continuous area right up the axis of the Coalburg coal basin—Sand Mountain—Raccoon Mountain—Walden ridge synclinal axis.

One basis on which the author had previously suggested tentative correlations was the assumption that the top of Hayes' Lookout sandstone was everywhere the Sewanee conglomerate horizon and that undoubtedly this sandstone continued uninterruptedly into the Birmingham quadrangle as the Boyles sandstone. This was consistent with the conclusions of McCalley, Stevenson, Hayes, Butts, and Wanless. But a glance at the mapping on either side of the common northeast corner of the Birmingham quadrangle and the southwest corner of the Gadsden and on either side of the common southwest corner of the Stevenson and the northeast corner of the Gadsden makes this doubtful. It *looks* as if Hayes mapped a *lower sandstone* in the Gadsden than in the Stevenson quadrangle or than Butts mapped in the Birmingham quadrangle. Of course, the areas do not exactly come together. Still, unless this explanation is accepted, (a) a steeper dip of Lookout beds or (b) a great thinning of the Lookout formation *in the Gadsden quadrangle exclusively* must be resorted to in order to explain the much wider Lookout formation outcrop areas in the Birmingham and Stevenson quadrangles. Judged from a study of his reports, Hayes seems to have used the *most prominent* sandstone

as his Lookout in Tennessee. Hence, it actually was part of the time the modern Sewanee conglomerate and part of the time the Warren Point sandstone. He possibly did the same thing in Alabama. In Alabama the section seems so greatly expanded and the sandstones so much less persistent and regular that it may not be possible to correlate coal beds by correlating sandstones above and below them, as apparently is so readily done in Tennessee.

The principle coal bed correlations, based on Hayes' sandstone identifications and on the assumed equivalency of the Sewanee conglomerate to the Boyles sandstone, were that of the Sewanee coal horizon with the Rosa group of coals, that of the Black Creek coal with the Tatum coal, and that of the Mary Lee group of coals with the coals above the Newton sandstone in Tennessee (Lantana and Morgan Springs). If, however, we abandon attempts at correlation through stratigraphy and take Butts' and David White's correlation of the Mary Lee and Sewanee groups of coal beds as the proved assumption, we may have correlations similar to Figure 2.

Figure 2 allows for many facts that appear to be both consistent and reasonable:

1. The entire column in Alabama is expanded, not just that part above the southern Tennessee units as in the writer's 1955 proposal.

2. The unconformity at the base of the Pennsylvanian in the Warrior field is still recognized, but only the Gizzard beds below the Warren Point sandstone of Tennessee are dropped out. This apparently is consistent with the Stevenson's conclusions and also with Butts' correlation of the Boyles with the Pine or second sandstone of the Cahaba and Coosa coal fields. It is consistent, too, with King's[21] picture of coal measures deposition which implies that older beds were deposited east and south of the Warrior field, not only in the Coosa and Cahaba fields but possibly in Lookout Mountain and the south and east side of Blount Mountain as well.

3. Hayes[7] shows all of the Walden formation to be eroded from Cumberland Plateau west of the Tennessee River, thus making sure that the top sandstone cliff in that area is equivalent to the Warren Point sandstone as implied by the Tennessee mapping[13] at the Alabama line. This fact makes it probable that a sandstone equivalent to the Warren Point *does* extend into the Birmingham quadrangle. Such a sandstone could, of course, have dropped out of the column, due to non-deposition or to erosion at the base of Pennsylvanian. Yet, if this did happen, some of the

geologists who studied the area should have observed evidences of it.

4. This picture allows for the Warren Point sandstone to be greatly expanded in Alabama as the Boyles sandstone (perhaps more than indicated, if the bottom of the Warren Point was not deposited) and the interval of the Wilder coals expanded, too, as the Rosa coal interval.

5. If the *entire Alabama column* is expanded in the Warrior field, then Hayes *did place* the top of his Lookout in the Gadsden quadrangle at some sandstone much too low, possibly one in the Rosa interval. The equivalent of the Sewanee conglomerate of Tennessee, if it exists at all in Alabama, might possibly be the Lick Creek and/or Bremen sandstone members. These two are not stratigraphically equivalent (Figure 2) but were deposited in different parts of the Birmingham quadrangle at slightly different intervals, although comparatively close, above the Black Creek coal bed.

6. The expansion, by Figure 2, of the Alabama column above the Black Creek bed is about equivalent to that below that bed. Such an expansion would place the top (Brookwood) group of Alabama (not shown on Figure 2) no higher than the Jellico horizon of Tennessee or possibly no higher than the Poplar Creek. This is in line with the paleontological evidence that causes Butts[22] to place the top beds of Warrior field in the lower part of the middle Pottsville.

The highest coals of northern Tennessee do not quite reach Allegheny age but are late Pottsville[14], as are the coals above the Montevallo bed in the Cahaba field of Alabama[22].

CORRELATIONS WITHIN ALABAMA

Several of the older writers have attempted correlations of coal beds and sandstones within Alabama. The writer has given little attention to this problem, so that only suggested correlations from the literature will be offered here.

Stevenson[2] discusses the sandstones and coal beds of the Cahaba and Coosa fields and of the western part of the Warrior field, but it is evident that he follows McCalley[10] and Gibson[19] in his correlations. Following McCalley, he says that both the Etna (Warren Point) and Bon Air (Sewanee) conglomerates are present all across northern Alabama to within three miles of the Mississippi line. This conclusion is by no means certain and has been questioned[11]. Stevenson also identifies both these sandstones with the Shades and Pine sandstones of the Cahaba and Coosa fields and treats them as constituting the "Millstone grit" in the southwest-

ern Warrior field in Jefferson and Tuscaloosa Counties. He suggests a red sandstone in Walker County as being ". . . a little way below the Third conglomerate" but states that ". . . the section in this county, as well as in Fayette and Lamar westward to the Mississippi border, does not reach downward to the Bon Air."

Gibson[19, 23] makes a few correlations from Blount Mountain to the Coosa field. All four of the conglomerates he saw in Blount Mountain he names also in the Coosa coal field. He suggests the correlation of the Bynum coal bed, that is just above the Fourth conglomerate in the Blount Mountain field, with the Hammond coal bed, which is above the same member in the Coosa field. He[19] leans toward the correlation of his Fourth conglomerate with the Cossa conglomerates (Montevallo and Straven) of the Cahaba field. Rothrock[24] believes that correlation with the Straven conglomerate to be correct.

Butts ventures a number of correlations. He states[15]:

> . . . David White concludes that the Black Creek coal of the Warrior field and the Harkness coal of the Cahaba field lie near the same geological horizon. He is also inclined to associate the Rosa and the Mary Lee beds of the Warrior field with the Gould and the Wadsworth beds, respectively, of the Cahaba field.

Butts confirms these correlations in another work[16] and adds the correlation of the Pratt bed of the Warrior field with the Clark (Woodstock) and possibly with the Little Pittsburgh beds of the Cahaba field. Regarding the age of Alabama coals he says in the same work:

> . . . the same horizon is therefore approximately represented by the Soddy coal of Tennessee, the Mary Lee and Newcastle coals of the Warrior field, and the Wadsworth bed of the Cahaba field, which are thus several hundred feet below the top of the lower Pottsville.* The still higher coal measures of the Warrior field fall in the middle Pottsville, no upper Pottsville being present in that field. In the Cahaba field the upper Pottsville is represented by the Montevallo and higher coal beds, the boundary between the middle and upper Pottsville lying near the Helena or Yeshic coal.

Figure 3 shows a modification of Butts' correlations[16]. To his original diagrams this writer has added certain sandstones to indicate their approximate place in the stratigraphic column. Although Butts does not draw correlation lines between the upper parts of the Cahaba and the Coosa field columns, he states[16]:

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* *He states that White considers the top of the lower Pottsville to be the top of the Lee formation of Virginia and of the Rockcastle sandstone of Tennessee.*

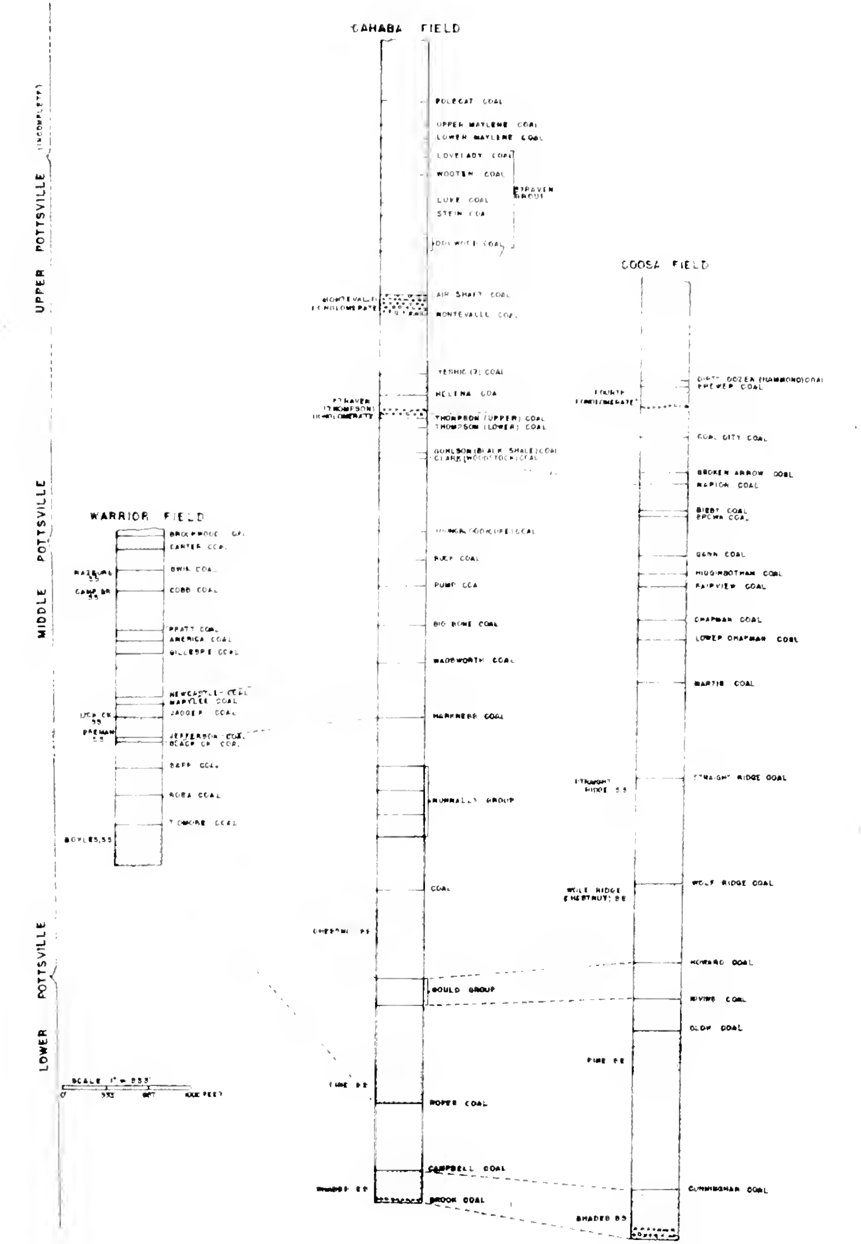

FIG. 3—Diagram showing correlations between coal beds and some sandstones and conglomerates for the Alabama coal fields, modified from Butts[16].

> The higher beds of the Coosa basin are tentatively correlated in a general way with the beds shown opposite them in the Cahaba field . . .

He does show a dotted line from the Brock coal of the Warrior field to the bottom of the Cahaba field column (Shades sandstone), rather than to the Pine sandstone, in one report[16] but corrects it in another[22] by showing dotted lines to both basal sandstones! The two question marks in Figure 3 are correlations not specifically found in Butts' reports.

SOME PROPOSED CORRELATIONS AND IDENTIFICATION PROBLEMS

From the number of reports and pages that have been written on Alabama coals, although most of them are old, and from the number of correlations apparently agreed upon by two or more writers, one might be tempted to think that the subject had been pretty well exhausted. Such is far from the case, however. Many important problems remain unsolved; others have tentative and unsatisfactory solutions. Most distressing of all, the basic information necessary for the satisfactory resolution of many of these problems simply is not available. The field job done by the older geologists around the turn of the century was truly remarkable, when one considers the poor base maps with which they had to work. It takes nothing from the credit due them to say that a really detailed treatment of Pennsylvanian stratigraphy in Alabama largely awaits the preparation of adequate topographic maps of all the coal field areas. The fine job done on coal measures stratigraphy in recent years in Tennessee would have been far less adequate had it not been for the wonderful 1:24,000 topographic map of the Cumberland Plateau which the Tennessee Valley Authority and the USGS have prepared during the past 27 years.

To be specific, the work necessary to provide the basic data from which to compile a complete picture of the Alabama coal fields and their stratigraphic and time relationships would involve all or most of the following:

(a) Adequate topographic maps of the south Cullman, south Gadsden, south and northeast Ft. Payne, west Springville, and northeast Birmingham quadrangles. Other areas badly needing maps are between 34° and 34° 15' latitude, west of the Cullman quadrangle; between 33° 30' and 34°, west of the Jasper quadrangle; and between 33° and 33° 30' latitude, just west of the Samantha and Tuscaloosa quadrangles. One fourth of the old Jasper (1:125,000) and ½ of the old Birmingham quadrangle are mapped on a 1:62,000

base as are the Samantha, Searles, Yolande, Bessemer Iron District, Vandiver, Tuscaloosa, Cottondale, Blocton, Montevallo, Columbiana, Mt. Hope, and Danville quadrangles. These maps are good but are on somewhat too small a scale.

(b) After providing adequate base maps we need some good, routine geological mapping on the same scale or larger and at least as detailed as that done by Butts in the Bessemer-Vandiver and Montevallo-Columbiana quadrangles. These folios of Butts, together with his Birmingham folio (which is excellent but on a scale of only 1:125,000) take care of a large part of the Cahaba and Coosa coal fields. Mapping of the Blocton and the southwest ¼ of the Springville (1:125,000) quadrangles would almost completely cover these two coal fields.

The really woeful shortage of adequate mapping is in the Warrior field. Butts' Birmingham folio and a tiny corner of his Bessemer map constitute the total. McCalley's Warrior field map is a remarkable job to have been made without an adequate base but it does not meet modern standards. The same is true of Hayes' folios. A report on each of the Birmingham Coal Districts—Port Birmingham, Yolande and Searles quadrangles, comparable to the Bessemer or Montevallo quadrangle reports in detail—would give a pretty good picture of the heart of the Warrior coal field. The remaining ¾ of the old Jasper quadrangle (Port Birmingham is the southeast ¼) has adequate topographic maps and should be added to this list as the Black Creek, Mary Lee, and Pratt groups of beds all outcrop across it.

In order to settle the questions raised here regarding stratigraphic relations in the coal measures below the Black Creek bed, the old (1:125,000) Fort Payne, Gadsden, and Cullman quadrangles and at least two others to the west of the Cullman should be mapped. To this would have to be added the Stevenson and Scottsboro 1:125,000 quadrangles to the 35° latitude just above the Tennessee state line.

The mapping tasks suggested above are necessary to provide basic data for the solution of more specific problems in coal bed and sandstone correlations and in structural relations. What are some of these specific problems? Of the many that have occurred to the writer since he began thinking about the subject, the following seem to be most vital and promising:

1. Does the capping sandstone on the Jackson County plateaus, west of the Tennessee River, continue through the Gadsden quad-

rangle on the west side of Sequatchie (Blountsville) Valley as a traceable unit? If it does do so, does it merge into the Boyles sandstone? If it does not, is the capping bluff in Marshall and Blount Counties higher or lower stratigraphically? The answer to this question is vital not only to coal bed correlation problems but also to the problem of the extent of the unconformity at the base of the Warrior coal field.

2. Is the rim-forming cliff of western Jackson and Madison Counties the same cliff-forming sandstone as that which stretches west from Sequatchie Valley across Marshall, Morgan, Cullman, Lawrence, and Franklin Counties? If it is, the unconformity at the base of the Warrior field is fairly small in its northern part; if the sandstone is not a continuous unit, then the gap at the base of the coal measures may be considerably greater.

3. At least three important structural problems may affect the origin and extent of the unconformity at the base of the Warrior coal field. The first of these problems is: Did the Sequatchie anticline have anything to do with the unconformity? Did the anticline antedate the Pennsylvanian or is it merely coincidence that the unconformity appears to extend only a short distance to the east of the anticline and seems practically to disappear close to the Murphree's Valley anticline, which is the next one to the east?

4. The second structural problem relates to the role of the southwestern end of the Cincinnati-Nashville uplift in Warrior coal field stratigraphy. Was it a source of some of the sediments, especially the sandstones in Lawrence, Winston, Marion, and Franklin Counties? Was it possibly emergent during parts of early Pottsville as has been suggested[11]? The solution of this problem might even be of assistance to those thinking about possible oil and gas reservoirs in the Warrior basin.

5. A third structural problem relates also to the Sequatchie Valley and perhaps, vaguely, to the Nashville uplift. In recent years the Tennessee geologists have become convinced that the Sequatchie Valley anticline, which begins in Cumberland County only some 30 miles south of the Kentucky state line, and the Walden Ridge syncline, which is eroded away or thrust northwestward north of Briceville, Tennessee, are not ordinary unsymmetrically folded structures. They think that both have actually been thrust a few miles northwestward in a similar manner, although perhaps not quite so far, as has the better known Cumberland thrust sheet of Tennessee, southwestern Virginia, and eastern Kentucky. The situation has been described in detail by Rodgers[25] and Stearns[26].

The latter further suggests that at least a torsional effect, if not actual thrusting, may also be found near the southern end of Sequatchie Valley in Alabama, similar to the condition that seems to exist at and near the Russell Fork fault of Virginia at the northeast end of the Cumberland fault block. Meager evidence from rank changes in coals near the Sequatchie anticline in Alabama are consistent with this view[27]. A careful and detailed study of stratigraphy and structure in the Birmingham, Cullman, and Gadsden quadrangles might give some evidence for or against this theory.

6. The relation of the stratigraphy of Blount Mountain to that of Sand and Lookout Mountains and to the Cahaba and Coosa coal fields is still as puzzling as McCalley and Stevenson found it to be. Stevenson[2] says that Gibson[19] undoubtedly exaggerated the thickness of the Blount Mountain strata as well as the thickness and number of the coal beds there. From two days spent on Blount Mountain a few years ago, the writer agrees with that judgment of Gibson's work. If we allow for considerable exaggeration, however, the fact remains that the geologic column is much longer in Blount Mountain than in adjoining areas.

Geographically, Blount Mountain is a part of Sand Mountain. It is simply split off Sand Mountain on the east side by the Murphree's Valley anticline. Chandler Mountain is also separated slightly from the southern part of Blount Mountain by the Greasy Cove anticline. The west side of the Blount Mountain syncline is said by McCalley[10] to be *thrust under* the Murhpree's Valley anticline on a contrary northwestward-dipping fault, which explains why the geologic column was so extensively protected from erosion in Blount Mountain. Correlation of coal beds and principal sandstones with units on Lookout Mountain, about 15 miles northeast (only 10 miles from Chandler Mountain); Sand Mountain, 4 miles west; the Cahaba coal field, 4 miles south; and the Coosa coal field, 12 miles southwest, is incomplete and unsatisfactry. An adequate correlation would perhaps do more than any other single accomplishment to clarify the original depositional picture of the Alabama coal measures.

7. There are many thick and persistent sandstones in the upper strata of the Warrior coal field that are not mapped or correlated, even locally. Figure 2 shows the ones named by Butts in the Birmingham quadrangle[15].

Many of these sandstones are present in other parts of the field. Butts[16] found them all present in the Bessemer quadrangle. The writer has seen a thick sandstone below the Cobb coals on

Alabama 69 and Alabama 13 in Walker County, showing that the Camp Branch sandstone may extend westward and may be even thicker and better developed than in the Birmingham quadrangle.

A sandstone above the Pratt group of beds is also very strongly developed on Alabama 69 south of Oakman. The picturesque cliffs along the Warrior River below Lock 14 are made by a thick unidentified sandstone above the Gwin bed, as it is mapped by McCalley.

The Bremen sandstone extends west of the northwest corner of the Birmingham quadrangle where Butts mapped it. About a month ago the writer visited the lookout point below the new Lewis Smith dam of the Alabama Power Company and found it affords a beautiful view of a sandstone cliff, just below which the diversion tunnel is pouring out the Sipsey Fork of the Warrior River. As the Black Creek coal was also said to have been encountered in that tunnel, the cliff must be of Bremen sandstone. A fairly thick and sometimes soft sandstone, seen nearly everywhere above the Black Creek (or Jefferson) bed in Marion and southwest Winston Counties, may be a still farther westward extension of the Bremen sandstone.

8. Where did the Bremen sandstone come from? This would make an interesting study. Butts shows no vestiges of it in the Birmingham quadrangle to the east of the eroded Sequatchie anticline although, as mentioned above, the Lick Creek sandstone does come in here at possibly a little higher horizon. The Bremen sandstone is right down close to the Black Creek coal bed in the Arkadelphia area but is reported missing above the coal north of Ryan's Creek*. If it extends westward as far as Brilliant in Marion County, but not eastward, was it derived from the east or from the Nashville dome, or at least from basal Pennsylvanian sandstones being eroded to the north in the present Tennessee Valley region? Could it be long and comparatively narrow toward the west, such as the thicker phases of some northern Tennessee sandstones[13], and therefore probably represent deposition along a large east-west flowing river? Or is it more like a great flood plain from the north where many short stream deltas coalesced? If so, it should perhaps be finer-grained toward the south. Accurate lithofacies mapping of the member, a study of the prevailing orientation of cross-bedding, etc., and a study of the size distribution and mineralogical content of the Bremen sandstone grains should solve the

* *Private communication from a strip coal mine operator in the area.*

problem—if not too much of it has been removed by erosion.

9. Is the "Millstone grit"—found near the base of the coal measures below the Black Creek bed and in almost all deep drill holes from Franklin to Tuscaloosa Counties—the same as the Boyles sandstones? Is it the same as the "Millstone grit" of the Blue Creek anticline in Jefferson and Tuscaloosa Counties? And is the "Millstone grit" of the Blue Creek anticline and the Little Basin equivalent to the Shades or the Pine or the Chesnut sandstone of the Cahaba field 5 miles to the southeast of the Little Basin? More deep drilling may be necessary to prove some of these relations but a study of mineralogical compositions might help. The problem of the extent of the unconformity at the base of the Warrior coal field might be practically solved by properly "pegging" some of these lower sandstones.

10. Are the Cahaba and Coosa coal fields low angle thrust sheets, similar to the Cumberland thrust sheet? They could be. In spite of supposedly thicker and later deposition in these two basins, the coals are of considerably lower rank than those 10 miles or so away across Jones Valley on the edge of the Warrior field[27]. Was this because the strata of the Cahaba and Coosa fields yielded under pressure and slipped northwestward while those of the Warrior field do not? Deep drilling, very detailed stratigraphic study, or laboratory study of metamorphism—not only of the coals but of other beds as well—should answer this question.

11. What is the relation of the thin irregular coal beds below the Black Creek bed in the Birmingham quadrangle to those in the northern part of the field in Winston, Marion, Lawrence, and Franklin Counties? Only one report[11] seems to mention any relation, and it will be an especially difficult problem to solve as the distance is so great. Like several of the other problems mentioned, its solution would shed much light on the extent of the unconformity at the base of the Warrior field Pennsylvanian.

12. The paleogeography—including the determination of source direction of sediments—of some of the major groups of coal beds (such as the Black Creek, Mary Lee, or Pratt) would not only be of great interest from the standpoint of geological science but might be of economic value by indicating preferred areas for exploration for beds of workable thickness in the lesser known parts of the coal fields.

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The Effects of Industrial and Domestic Pollution of the Black Warrior River on the Net-Plankton Population*

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Alabama streams have had little study with regard to biological effects of pollution. The Black Warrior River in the Tuscaloosa area is a deserving subject. This section of the Warrior is a classic example of both industrial and domestic pollution. Some 25 years ago the city of Tuscaloosa abandoned the river as a source of domestic water because the nature and volume of this contamination rendered the water unfit for domestic use.

Chemical and physical studies[1] made of the river water in this area established the fact that gross pollution existed. However, the writer was unable to find any record of systematic inquiry into the biological effects of this pollution.

Stream pollution results in an alteration of environmental factors to which aquatic organisms respond by changes in such things as rate of growth and reproduction. Environmental changes which may be induced by pollution include increase in stream temperatures modification of the character of the stream bottom, increase in turbidity, changes in dissolved nutrients, production of undesirable growths, and addition of toxic wastes[2]. While some consequences of pollution may be favorable to certain organisms, generally they are unfavorable for the organisms as a whole and high pollution concentrations change the pre-existing numbers and proportions of aquatic life forms.

A biological index is valuable in determining human and wildlife values of a stream because it is less variable than instantaneous measurements of a chemical-physical nature. But even more important is the fact that it reflects the actual effects of the pollutants. A dependable biological index is furnished by the plankton

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* This report is based on the author's master's thesis, *The Effects of Industrial and Domestic Pollution of the Black Warrior River in the Vicinity of Tuscaloosa, Alabama, on the Net Plankton Population.* It was done in 1955 in the Department of Biology of the University of Alabama. The University's Gorgas Library has copies of the full thesis.

The writer wishes to express his sincere appreciation to Dr. E. G. Patton for his advice and assistance throughout the study. Other members of the Biology Department and Professor J. M. Faircloth of the University's College of Engineering offered many helpful suggestions, all of which are gratefully acknowledged.

population, since the autotrophic plankton* forms constitute the base of the aquatic food chain.

This study, made in 1955, is a comparison of the net-plankton population immediately upstream from Lock 14 with that found immediately upstream from Oliver Dam. The water above the dam at Lock 14 was relatively non-polluted; and the water at Oliver Dam, extremely polluted[1]. Carrying effluents into the river between Oliver Dam and Lock 14 were 6 industrial sewers and 13 sanitary sewers in 1955. These 19 sources deposited approximately 34,000,000 gallons of wastes each day which polluted the water at the Oliver Dam sampling station (and to an undetermined distance downstream). Domestic sewage accounted for about 2,200,000 gallons and the remaining 31,800,000 were of an industrial nature, including wastes from the manufacturing or processing of phenols, resins, color pigments, tall oil, asphalt, fuels, coke, artillery shells, and kraft paper.

MATERIALS AND METHODS

To determine the effects of water pollution on aquatic organisms, simultaneous samples are needed from waters differing only with respect to pollution "load." The water at Lock 14, which was relatively non-polluted, and that at Oliver Dam, which was extremely polluted, met this requirement. Sites at these two locations therefore, were chosen as sampling stations.

A basic criterion for selecting these stations was accessibility from the shore to water in the main stream, since all samples were obtained approximately three feet from the bank. Special care was taken to locate stations at points showing similar conditions with regard to type of bottom, shade conditions, type vegetation on the banks, flow obstructions along the banks, depth of water, and distance from single pollution outflows.

The plankton populations at the two sampling locations were compared on the basis of (a) total plankton populations, (b) total phytoplankton populations, (c) total zooplankton populations, and (d) number of organisms present in each of the following groups: blue-green algae, Vovocales, filamentous green algae, desmids, diatoms, Sarcodina, rotifers, copepods, Cladocera, flagellate protozoa, dinoflagellates, and rotifer eggs. Those organisms encountered which could be placed in none of these groups were treated under

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* *The term autotrophic plankton is used herein with reference to small, usually microscopic, free-floating organisms capable of photosynthesis.*

the general headings of "other phytoplankters" and "other zooplankters."

Although it is recognized that genus and species identifications would likely prove valuable in a study of this type, lack of time precluded such a broad undertaking.

Plankton sampling of a quantitative nature involves the separation of organisms from known quantities of water. There have been several methods devised for this, one of which is the plankton net.

The sampling apparatus that proved most satisfactory for this work was a cone-shaped No. 25 silk plankton net (mesh, 0.03 to 0.04 mm.) which was attached to the bottom of a 7-inch funnel with a metal cuff, extending the length of the funnel by approximately 6 inches. The net tapered toward the bottom until it was 2 inches in diameter. The mouth of a collecting bottle was attached inside the bottom of the net with a rubber band. A smaller rubber band was placed around the outside of the net immediately above the mouth of the collecting bottle. This channelled into the collecting bottle the material strained out by the net as the water level fell in the net-funnel apparatus, thus minimizing the common sampling error caused by the adherence of organisms to the side of the net and around the mouth of the collecting bottle.

This plankton net-funnel apparatus was mounted on a 6-inch metal ringstand approximately 9 inches in height. A sample of 20 l. was taken from the river surface with a calibrated bucket. Following this procedure, each completed sample represented exactly 20 l. of river water.

The capacity of the collecting bottle was exactly 10 ml. After 20 l. of water had been strained through the net the collecting bottle was detached and its contents were transferred to a labelled vial to which were added 10 ml. of formal-alcohol preservative. This preservative was made up of 95 parts of 100 per cent ethyl alcohol and 5 parts of commercial formalin. The volume of the fixed concentrate was 20 ml., which represented a sample of 20 l. of river water.

Other materials used included a Fahrenheit thermometer with which the temperature, approximately 4 inches beneath the surface of the water, was determined for each sample. The rate of flow, in feet per minute, was estimated on the basis of the time required for a bottle, half filled with water, to be passively carried downstream 25 feet. These data, and other pertinent information such as water level, weather conditions, and previous rainfall were recorded on the label of each sample.

The concentrated water samples were analyzed in the laboratory in the following way. After the concentrate had been thoroughly shaken to insure uniform distribution of organisms, a subsample of 1 ml. was taken with a dropper and put in a No. 800 Sedgewick-Rafter counting chamber for differential counting. The counts were made under 100-power magnification on the mechanical stage of a compound microscope. The results were tabulated on mimeographed forms. Three subsamples were counted for each sample and the average was considered to be representative for that sample, since the standard deviation was nearly always low. The number of organisms per ml. of concentrate represented the number of organisms per l. of sampled water, because the sample was concentrated corresponding to these proportions.

Nine samples were taken from each of the two sampling stations at increasingly frequent intervals between February and July, 1955. Preliminary sampling was done approximately one month prior to scheduled sampling. This extended the sampling period to about five months and the number of samples to ten.

RESULTS

From the first sampling date, February 26, 1955, to July 1, 1955, which was the date of the last sample, there was a steady increase in the water-temperature from 54° F to 82° F.

The total plankton populations increased in size at both sampling locations during this period of time corresponding in general to the temperature rise.

The number of organisms in many of the groups varied greatly between the two sampling locations. Blue-green algae, desmids, copepods, Cladocera, and dinoflagellates were represented at both stations by relatively small populations throughout the collection period. It was noted, however, that the populations of copepods and Cladocera were generally greater at Oliver Dam than at Lock 14 and that the greater differences occurred at times of low water.

The diatom population, during the period from April 30 to May 22, a low water period, was at least 149 per cent greater at the Lock 14 station. The blue-green algae were represented at the Lock 14 and Oliver Dam stations in the samples during this same period by a ratio of 14 to 1, respectively. On five sampling dates, filamentous green algae showed a population at the Lock 14 location of almost twice that at the Oliver Dam location. The flagellate protozoa population showed a sudden increase at Lock 14 in the sample of May 22 and reached a peak on June 8 of 182.0 organisms per liter. At Oliver Dam, in contrast, the increase was very slight and at-

tained a high of only 13.3 organisms per liter. The groups—diatoms, blue-green algae, Sarcodina, rotifers, copepods, Cladocera, and dinoflagellates—at various times showed higher populations at the Oliver Dam station, but these differences were usually of much less magnitude and prevailed over shorter periods than those mentioned above.

Within the rotifer group there were similar population trends at both stations and remarkable congruity between population sizes. This is also true of the groups, Sarcodina and Vovocales. For any one of these groups there were no more than two samples in which the populations differed appreciably between the sites.

The total number of plankton organisms varied greatly between the sampling locations (Figure 1). During the entire period from February 26 to July 1, the total plankton population at Lock 14 averaged at least 39 per cent greater than at the Oliver Dam station. Throughout the low water period from April 30 to May 22, samples showed the total population to average at least 88 per cent higher at the Lock 14 station. Samples taken February 26, April 1, and June 18—representing high water conditions—showed the closest agreement between the total plankton populations at the two sampling stations. For these periods Lock 14 still had 13 per cent more total organisms.

The total zooplankton population showed parallel trends at both stations, except for the sample of July 1. On this sampling date the Lock 14 population showed a decrease while the Oliver Dam population showed an increase. Throughout the collection period the Lock 14 population was greater than at Oliver Dam, except for those samples taken June 18 and July 1.

The total phytoplankton population showed trends which were often alike at both stations with the only departure from a common trend being in the June 18th sample. In all samples except those of February 26 and June 8, however, the Lock 14 population was conspicuously greater than that at Oliver Dam.

DISCUSSION

Different schools of thought exist concerning the use of "indicator" organisms as an index to the condition of a stream[3]. Many organisms can live in normal as well as in various polluted conditions; instead of being specific for a given condition, they are tolerant of wide changes in the environment[4]. It seems more important to consider the absence or reduction of certain populations under conditions of pollution, rather than the presence of groups

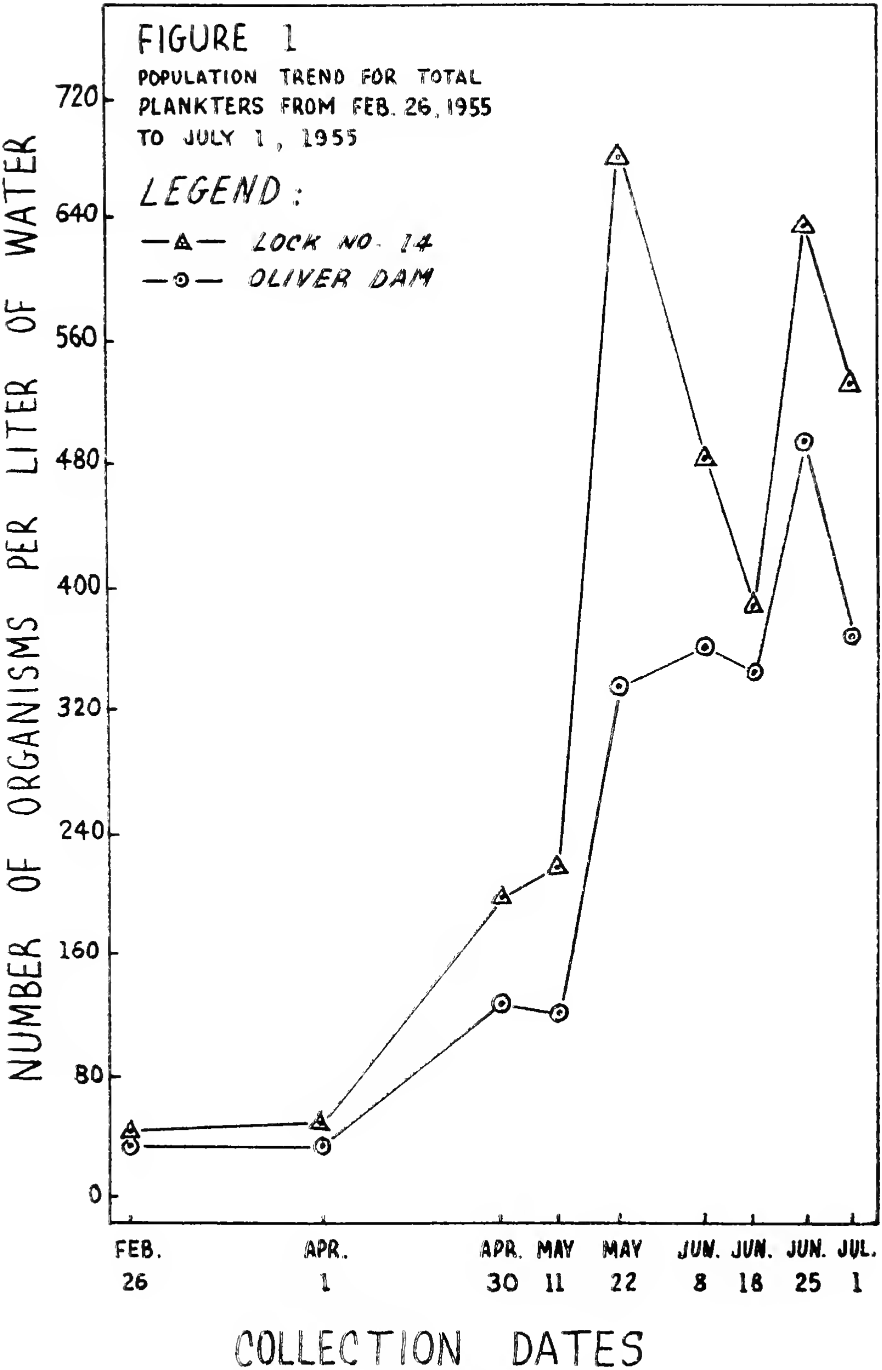
FIGURE 1
POPULATION TREND FOR TOTAL PLANKTERS FROM FEB. 26, 1955 TO JULY 1, 1955
LEGEND:
LOCK NO. 14
OLIVER DAM
NUMBER OF ORGANISMS PER LITER OF WATER
720
640
560
480
400
320
240
160
80
0
FEB. 26
APR. 1
APR. 30
MAY 11
MAY 22
JUN. 8
JUN. 18
JUN. 25
JUL. 1
COLLECTION DATES

exclusively in polluted waters, as "indicators." This is taken as a guiding principle in the analysis which follows.

Fluctuations in the Warrior River environment include seasonal temperature change, spatial and temporal variation in concentration of pollutants, and fluctuation in stream flow volume and velocity. This last is primarily controlled by human decisions, except for periods of unusually heavy precipitation. It is apparently the principal factor affecting the fluctuation in pollution intensity and therefore the plankton-sampling results of this study.

There are several aspects which should be considered in regard to the effects of streamflow on plankton populations.

The first two samples were taken during a flood period, and at the time of the third sample the water level was still slightly high. In general, the populations of all groups were low during this period, as evidenced by the total plankton population (Figure 1). The population differences between stations were also low. At times during the remaining sampling period it was noted that two or three days of relatively high water would usually initiate a downward population trend—an effect similar to that described above.

High water in a stream is usually accompanied by an increase in rate of flow, poor light penetration due to turbidity from suspended material, and generally unfavorable conditions for plankton growth and reproduction[5]. An increase in the rate and volume of flow flushes plankton organisms downstream; therefore, the population of a given area during high water is not necessarily typical for that environment. Intensity of pollution is altered by the dilution effects of the excess water and rapid transport of pollutants downstream, whereas during periods when currents are almost negligible the pollutants are held in more restricted areas and the concentration builds up locally as the stream receives more and more wastes. Since the Warrior River in the Tuscaloosa area is a relatively low-volume, slow-flowing stream on an annual basis, the biotic potential of the stream is primarily based on low-water conditions and pollution becomes a primary influence on the life supported by the stream.

An analysis of the data gathered in this study allows two early generalizations: first, for any given sampling date the total Lock 14 plankton population was usually greater than that at Oliver Dam, and second, for any given plankton group the population trends were usually similar at the two stations.

Certain plankton groups which were present only in small num-

bers deserve discussion. Dinoflagellates, blue-green algae, desmids, Cladocera, and copepods showed comparatively small populations throughout the sampling period at both stations. While the dinoflagellate population was absent, or so low that subsample counts were meaningless in terms of the standard deviation for the first five samples at both stations, still for the last two samples the Lock 14 population was conspicuously greater than that at Oliver Dam. In the blue-green algae group there were five samples which showed the population size to increase at one station with a concurrent decrease at the other. This group is the major exception to the general coincidence of population trends at the two sites. For this group, the May samples showed the populations to be approximately 13 times greater at the Lock 14 location. The population of the desmid group showed similar trends for both stations with only one departure from this trend occurring at the time of the July 1 sample. The population trends between and within the groups, Cladocera and copepods, for both stations were generally similar with peaks for both groups being at the Oliver Dam station at times of low water. These two groups constituted examples here of "indicators" in the sense of forms more abundant in polluted water.

According to Lackey, diatoms are not tolerant of pollution[6]. It is of interest, therefore, that the samples of February 26 and June 18, representing high water conditions and consequently low pollution-loads, were the only samples wherein the populations of diatoms were not significantly greater in the non-polluted water at Lock 14. The Lock 14 sample taken May 22 showed the diatom population to be 264.0 organisms per liter while at Oliver Dam it was only 96.3. These were the highest populations for a single group on any given sampling date throughout this entire investigation.

Filamentous green algae showed a less variable population at the Oliver Dam station than did any other group which was represented by a relatively large population at either station. However, it was generally at least 35 per cent greater at the Lock 14 station. As might be expected, samples taken during a low water period, those of April 30, May 11, and May 22, showed the Lock 14 population to be nearly 100 per cent greater.

In the May 11 sample was the first occurrence of the flagellate protozoa. Throughout the remaining sampling period this group was represented by a much greater population at the Lock 14 station than at the site of pollution. *Dinobryon* was the genus most

numerously represented in this group. Records of previous studies establishing the sensitivity of this group to pollution were not found in the literature. On the basis of the data from this investigation, however, it seems that this group, or the genus *Dinobryon* at least, was sensitive to the degree of pollution which characterized the Oliver Dam sampling station.

The Sarcodina population trends for the entire collection period were identical for both stations; that is, when the Lock 14 population increased or decreased there was a population change at Oliver Dam in the same direction. The population sizes varied between stations: at times it was larger at Lock 14, while for other samples it was larger at Oliver Dam. Five samples showed the Lock 14 population to be larger. Yet these differences were of much less magnitude than the diffences at the time when the Oliver Dam population was greater. These data indicate that this group was indifferent to the degree of pollution at Oliver Dam and perhaps even favored that environment. The population trends for Vovocales were quite similar to those described for Sarcodina, though population differences between sites were generally less than for Sarcodina. Lackey has pointed out that these groups, Sarcodina and Vovocales, are known to tolerate pollution[6].

As stated earlier, there were similar population trends for the rotifers, with remarkable congruity between population sizes at both sampling stations. There were only six samples which showed appreciable differences of populations between sites and for four of these the larger population was at Oliver Dam. Rotifer populations are often greater in polluted waters[3].

In considering the effects of pollution on the plankton population from a practical standpoint, such as a food source for fishes, the important question is whether the total available fish food has been reduced[7]. An evaluation as food of each species of plankton or each group as used in this study is not available. It cannot be said, therefore, that the total available fish food is lower at Oliver Dam than at Lock 14. It can be said, however, that the total plankton population was in general conspicuously lower at Oliver Dam (Figure 1). Because of the magnitude of these differences, especially during periods of relatively low water, it seems very likely that the total available fish food is less at Oliver Dam.

The data accumulated in this study point to several groups as possible pollution "indicators." Sarcodina, rotifers, and Vovocales seemed to thrive under conditions of pollution and to qualify as "indicators" in this sense. If "indicators" are thought of as or-

ganisms whose populations are noticeably reduced by pollution, then diatoms, filamentous green algae, and flagellate protozoa seem valuable for this approach. A taxonomic breakdown of these groups in a study as the one here presented would no doubt show that certain genera and perhaps even species would be much more sensitive "indicators" than the groups taken as a whole.

It should be emphasized at this point that the populations of plankton may be actually increasing under conditions of pollution and of low water which increases the concentration of this pollution. But the rate of population increase is less than that of the populations in comparable but non-polluted water, so that with continued low water the percentage differences in the sampling results grow larger. Thus, within limits, the real decrease of biotic potential with increase of contamination may be apparent only from comparative sampling as was done in this study.

The total phytoplankton population was affected to a greater extent by the pollution than was the total zooplankton. That zooplankters are relatively more numerous than phytoplankters in polluted waters has been pointed out by many workers[5]. Brinley states that phytoplankters as a whole are sensitive to pollution[8].

This study furnished two correlations necessary to complete the description of the pollution of the Black Warrior River in the Tuscaloosa area in 1955: First, the water at Oliver Dam was polluted to the extent that the plankton population as a whole was adversely affected; second, certain plankton groups served as "indicators" of this pollution.

CONCLUSIONS

1. The degree of pollution which characterized the water at Oliver Dam in 1955 was such that it adversely affected the total plankton population.

2. The total zooplankton was more tolerant of the pollution than was the total phytoplankton.

3. Rotifers, Sarcodina, and Vovocales were the groups most tolerant of pollution.

4. The flagellate protozoa, principally made up of *Dinobryon* spp., were more adversely affected by the pollution at Oliver Dam than was any other group observed in this study.

5. The flagellate protozoa occurred in the last six samples only. This apparently was a seasonal response. They were absent in late winter, occurred in mid-spring, and persisted throughout the remainder of the sampling period which ended in early summer.

6. Low water conditions in the river produced the following

effects: The greatest populations of total plankton, total zooplankton, total phytoplankton, and of all groups except Vovocales, Sarcodina, rotifers, and dinoflagellates; and the greatest percentage differences between stations.

7. Sarcodina, Vovocales, and rotifers were pollution "indicators" in the sense that they were more abundant in the polluted than in the non-polluted water; whereas the populations of diatoms, filamentous green algae, and flagellate protozoa were noticeably reduced by pollution and served as "indicators" in this sense.

SUMMARY

1. As of 1955, the Black Warrior River in the Tuscaloosa area had been shown by chemical-physical studies to be grossly polluted. Between Lock 14 and Oliver Dam were discharged daily into the river about 34,000,000 gallons of wastes of both industrial and domestic origins.

2. Previous systematic studies on the biological effects of this pollution were not found in the literature.

3. Plankton organisms make up an important part of aquatic life; thus they furnish a dependable biological index to stream pollution.

4. Through the period from February 26 to July 1, 1955, nine concurrent net-plankton samples were taken from each of two stations located in the relatively non-polluted water at Lock 14 and in the extremely polluted water at Oliver Dam. These samples were analyzed in the laboratory where the individual organisms were counted and tabulated under generalized groups.

5. From February 26, 1955, to July 1, 1955, the water-temperature at the sampling locations steadily increased from 54° F to 82° F and in general the plankton populations followed a corresponding increase in size.

6. Flagellate protozoa, diatoms, and filamentous green algae showed highest sensitivity to pollution of any groups; while rotifers, Sarcodina, and Vovocales were most tolerant. Except for flagellate protozoa and filamentous green algae, these group responses to pollution have been previously reported in similar studies.

7. Phytoplankters were more adversely affected by pollution than were zooplankters.

8. The greatest populations of total plankton and of most groups and the greatest percentage differences between sampling stations occurred during low water periods.

9. For total plankters and for most groups the greater popu-

lations were usually at Lock 14.

10. This investigation furnished two correlations as a biological index to the pollution of the Black Warrior River at Tuscaloosa in 1955: First, the water at Oliver Dam was polluted to the extent that the plankton population as a whole was adversely affected; second, certain plankton groups served as "indicators" of this pollution.

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A Contribution to the History of Malaria

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Malaria was a scourge of the warmer parts of the world for many centuries. It has been suggested that it was largely responsible for the decline of civilization in Greece, Rome, and Yucatan. There was no known remedy for it until the discovery of cinchona bark in South America in the seventeenth century.

The word malaria is said to date back to 1740, but it does not appear in the mortality statistics of the seventh United States census (1850), which was the first in this country to report on health matters. However, there was quite a long anonymous article, "On malaria," in the *American Journal of Science* in 1830. (17:300-326. See also pp. 338-346 and 370-371 of same volume.)

In the mortality report for 1850, "intermittent fever" and "remittent fever" doubtless meant malaria, and it is a resonable assumption that the unspecified fevers in that report (which excluded scarlet, ship, typhoid, and yellow) were nearly all malaria. In a total population of 23,191,876 in 1850, there were 19,220 deaths reported from intermittent, remittent, and unspecified fevers—making up 5.84 per cent of the white deaths, 4.10 per cent of the free colored, and 6.77 per cent of the slaves. The proportions of course varied considerably in different states, but it would take too much space to go into that here. It can be noted in passing, though, that the low rate for the free colored must have been chiefly due to the fact that they were largely concentrated in the northern states.

We have a graphic account of the prevalence of malaria in southern Michigan a quarter of a century before the 1850 census report in an article by James Pierce, Esq., "Notice of the Peninsula of Michigan in relation to its Topography, Scenery, Agriculture, Population, Resources, etc.," in the *American Journal of Science* in 1826. (10:304-319. 1826. Quotation from p. 318.) He said among other things, "If that paralyzing disease, the fever and ague, should cease like an incubus to oppress the land, it may in forty years present a population of a million, busily engaged in agriculture, and commerce."

In those days it was thought that malaria was caused by a "miasma" that rose from swamps. At some later period it was noticed that screens gave some protection, and it was theorized by

some that the miasma was an invisible net that would not pass through a screen.

An article by Albert Phenis in the *Manufacturers' Record* for August 13, 1908, on New Orleans as a summer resort, discusses climate, yellow fever, etc., and says a learned South American physician, Beauperthuy, suspected the agency of mosquitoes in transmitting fevers as early as 1839, and published it in 1853. Some inkling of this must have soon come to Dr. E. W. Hilgard, state geologist of Mississippi, for in his classic report on the Geology and Agriculture of Mississippi (1860), in describing the marshes along the coast, he said among other things (p. 375):

> The great prevalence of these marshes . . . render it a matter of surprise to the visitor, that the health of the coast region is generally excellent. We can scarcely believe, that residences situated in the very edge of the great Pearl River Marsh, surrounded by it on three sides, and overrun at the proper season, with legions of mosquitoes of all colors and sizes should, nevertheless, be as healthy, or even healthier, than the much praised "Piny hills" of upper Mississippi; yet such is indisputably the case.

According to the *Encyclopaedia Britannica*, the "microbe" of malaria was discovered by Laveran in Algeria in 1880, but others thought they had traced it to a bacillus about a year before. A note in the *Popular Science Monthly* for July, 1882, attributes the discovery to M. Richard, a French pathologist. Be that as it may, no one at that time knew how the germ was transmitted to its victims, except for the 1839-1853 suggestion above mentioned.

A new chapter was written by Dr. A. F. A. King (1841-1914), of Washington, D.C., in an article on "Insects and disease—mosquitoes and malaria," in the *Popular Science Monthly* (23:644-658) for September, 1883. It was an abstract of a paper read before the Philosophical Society of Washington, February 10, 1882. He cited some previous work by himself and others, some as far back as 1873, that pointed to mosquitoes as the carrier of the germ, and presented several lines of circumstantial evidence that tended to strengthen that theory. In the same magazine four months later (24:410-411) A. G. Boardman of Macon, Georgia, was inclined to agree with Dr. King. But in the March, 1884, issue (24:700-701) a correspondent in southern Michigan, F. R. Stebbins, took issue with Dr. King, pointing out that mosquitoes were abundant in northern Michigan but malaria was unknown there. That seemed to stop Dr. King in his tracks; and the fact that he was known chiefly as an obstetrician may have tended to discount his views on mosquitoes. We know very well now that he made one slip—not dis-

tinguishing between different kinds of mosquitoes. Those in northern Michigan (and farther north, where they are pests in summer) must be all (or mostly) *Culex*, while the malaria carrier is *Anopheles.*

However, it is gratifying to note that early in the twentieth century, when the mosquito theory of malaria had been confirmed by workers in Cuba, Dr. King's pioneer work was recalled, and some of his friends in Washington gave a dinner in his honor.

An editorial in the *Popular Science Monthly* for January, 1884, on "The march of fever and ague," told how "intermittent fever" had advanced northeastwardly across Connecticut. Beginning about 1860 and reaching Windsor in 1875, it covered every town in the state and passed into Massachusetts at Agawam in 1878. It was then (1884) all over western Massachusetts and in a few places in eastern Massachusetts, Vermont, New Hampshire, and Rhode Island.

In the same magazine two months later another editorial described the conditions thought to be favorable to malaria in New Britain, Connecticut, such as muck and decaying vegetable matter.

Albany, Georgia, which is in a limestone region and on a muddy river, used to be a hotbed of malaria. In 1930 I gathered all the tombstone records I could find in the white cemetery there, averaged them by decades, and found that around 1880 the average white person there died at the age of 21; which must have been about the same as the average for India. Although Alabama had had artesian wells before that, the first successful one in Georgia was drilled near Albany by Col. John P. Fort in 1881. The longevity curve there took an upward turn immediately, and by 1930 the white people were averaging about 60 years at death, which was pretty good for that time. The explanation probably was that in that region (as in much of Europe) the water in shallow wells was hard or unsafe and the people depended mostly on rain water for their domestic supply (as in New Orleans until about 1906). And the malaria mosquitoes could breed freely in the cisterns (as the yellow fever mosquitoes did in New Orleans), which the artesian wells soon superseded.

The mortality volume of the 1890 census showed deaths from malaria in every state in the Union, totaling about 19,000; and of course the number of cases must have been very much larger, for malaria is not usually fatal. Malaria was the reputed cause of 1.76 per cent of the white and 4.8 per cent of the colored deaths; quite a reduction from the 1850 figures above mentioned, though the agency of mosquitoes had not yet been discovered. For whites the

lowest percentage by regions was 0.37 in New England, and the highest 8.2 in the West South Central group. The corresponding percentages for colored were 0.49 in New England and 9.00 in the West South Central states.

Long before the connection with mosquitoes was discovered, it had been observed that some sandy or elevated neighborhoods in malarial regions were relatively free from the disease. And some of them were given names suggesting such a relationship—e.g., Summerville and Mt. Pleasant, South Carolina, Summertown and Mt. Pleasant, Georgia, and Bellair and Mt. Pleasant, Florida.

Harry Hammond (1833-1916) had quite a good deal to say about this in his *Handbook of South Carolina* (1883), from which the following are brief quotations. In the coast region:

> . . . numerous localities along the coast, as Mount Pleasant, Sullivan's Island, and Beaufort were much frequented as health resorts during the summer months, even by people from the up-country.

In the lower pine belt:

> . . . there are found small tracts . . . of dry, sandy soil, heavily timbered with the long-leaf pine, which is a barrier to the invasion of malaria. These retreats furnish places of residence as healthy as are to be found anywhere; such a place is the village of Summerville, on the S.C. R.R., a health resort that divides with Sullivan's Island the patronage of the citizens of Charleston during the warm weather.

In George White's "Statistics of Georgia" (1849) there are brief comments on the health conditions of every county. Under Emanuel County one short paragraph says:

> Opposite to the Ninety-five mile station [on the Central R.R.] there is a settlement, made by some of the planters of Burke County, to which they resort in the summer for health.

This was evidently what was later called Summertown, on the Altamaha Grit excarpment a few miles south of the Ogeechee River. Under Wayne County he says:

> Near the village [Waynesville] there are many beautiful pine hills, with pure water, affording delightful summer residences for the wealthy planters of Glynn.

In a Florida handbook by Dennis Eagan, Commissioner of Lands and Immigration, published in 1873, one finds on page 11 an interesting statement about malaria.

> St. Augustine has long enjoyed a total exemption from all kinds of fever; Jacksonville is equally favored. In Pensacola the treatment of malarial fever is not a part of the practice of the city physicians.

The case of Bellair, Florida, is especially interesting. It is in a very sandy long-leaf pine region, a few miles south of Tallahassee. Tallahassee is in a region of red hills, with fertile somewhat clayey soil, numerous lakes and ponds, and very little running water. Cisterns must have been in common use. Bellair is at a lower elevation (imagined by some to be an old sea beach) and has many shallow stagnant ponds around it, which might seem to be ideal habitats for mosquitoes. But the water in the ponds is blackish and apparently acid, and presumably the malaria mosquitoes prefer turbid or somewhat alkaline water. (Northern Michigan has sandy soil and acid water, and Okefinokee Swamp in Georgia, likewise said to be free from malaria, is another acid-water area.)

Anyway, the ante-bellum planters around Tallahassee and the state officials in that city discovered long ago that Bellair was relatively free from malaria, and some who could not well go to the mountains for the summer built summer homes there. They could drive up to Tallahassee in an hour or less to attend to necessary business during the day. (*Ann. Rep. Fla. Geol. Survey*, 6:288. 1914)

After 1900, when the mosquito connection was discovered, it became much cheaper to screen houses than to maintain summer homes at Bellair, and Bellair declined. When I first saw it, in 1909, there was nothing there but a sign beside the railroad track and a few scattered Negro houses.

An interesting side light on malaria in Alabama in the last quarter of the 19th century can be found in Dr. Eugene A. Smith's *Report on the Geology of the Coastal Plain of Alabama* (1894). On pages 654-655, in the description of Butler County, he says:

> A well known topographic feature of this county is "the Ridge," which is the high land left by erosion between the waters of Wolf and Cedar Creeks which flow somewhat parallel with each other for several miles . . . Upon the ridge were the houses of the planters who cultivated the rich prairie soils of Cedar Creek lying at the foot of it towards the north. At the present time very few white families are to be found here, and the whole section, from long neglect, is badly cut up by gullies, and the once fine houses of early days have fallen into decay, and the Ridge now presents a scene of dilapidation painful to behold.

Nothing was said about malaria, but that must have been a factor in the decline, as it was in the abandonment, of the village of old Washington on the Alabama River in Autauga County where Dr. Smith was born in 1841. Anyway, I walked along the Ridge of Butler County one day in June, 1919, and its former prosperity seemed to have been pretty well restored.

Around the turn of the century, when the mosquito theory was just getting acceptance, it was common for hotels in the South to put canopies of mosquito netting over the beds. And some private homes had them too, for the added purpose of keeping off flies from people who wanted to take naps in the daytime.

Since then malaria has decreased rapidly in the United States and other civilized countries. In 1950 there were reported only 40 white and 36 non-white deaths from malaria in the United States, and the total decreased steadily to 14 in 1957. But it is still a problem in some tropical countries, such as Indonesia, which reports about 150,000 malaria deaths annually and is planning a ten-year campaign to wipe it out.

INDEX

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Papers and abstracts of papers to be published in the Alabama Academy of Science Journal may be submitted by both Academy and non-Academy members at any time during the year. Priority, however, will be given to material submitted by members of the Alabama Academy of Science.

Full-length papers which are submitted for possible publication will be judged by a review board on the basis of original data presented and upon the interpretation or review made of the materials presented within a limit of 15 printed pages. An article exceeding this limit will be charged at the rate of $10.00 per additional page. Papers must be submitted solely to the Alabama Academy of Science Journal and must not be reprinted in another publication without the consent of the editor.

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The manuscript should be typed double spaced allowing good margins. Captions and legends for figures should be typed on sheets separate from the text. Footnotes are not desirable and should be avoided whenever possible. Illustrations should not exceed 20 per cent of the text; the authors of more copiously illustrated articles may be asked to pay for the excess. The title of the paper should be as short as is consistent with clarity. Primary divisions may be indicated by central headings and subdivisions by italicized captions at the margin. Every paper should normally conclude with a summary of numbered paragraphs.

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All figures and tables should be numbered consecutively with legends included. Illustrations (including tables) should be planned to occupy the entire width of a page (4½ inches), and any portion of the height (7 inches). It is best to combine illustrations into the smallest possible number of groups. Original photographs should be submitted in the form of clear black and white prints on glossy paper. Care should be taken to see that they cannot be bent or folded in handling, and paper clips should not be used.

References:

References to literature should be cited by the author's name or by the literature cited reference number. The bibliography should be arranged alphabetically by author under the heading Literature Cited. Complete reference is necessary and the arrangement should normally be as follows: Harper, R. M. Some Menaces of the Study of Geology. Jour. of Ala. Academy of Science. 27:15-20. 1955.

Proofs and Reprints.

Galley proofs will be sent to the author, and the corrected proof and reprint order should be returned to the Editor. Page proofs will be sent only when necessary. Cost of reprints will be indicated at the time proofs are mailed. All manuscripts should be handed to the various Section Chairmen at the close of the Annual Academy meeting or mailed directly to the Editor of the Journal. All correspondence concerning the publication of papers, etc., within the Journal should be addressed to the Editor. Correspondence relative to securing copies of the Journal, should be addressed to the Archivist.

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